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ABSTRACT

Telework Centers are work locations used by firms to acommodate staff who live near the telework center location. A study examined the impact of using telework centers on communication, work groups/departments, performance, supervision, travel/environment, and type of work done in various locations. A case study approach was used to investigate 10 telework centers and 2 resort offices in the United States, Canada, and Japan. Questionnaire, interview, and archival data were collected. Telework centers had primary (transportation issues, economic development, marketing) and secondary drivers (quality of life, cost reduction, better way of working, disaster recovery). Goals and objectives for telework centers related to the drivers were reducing traffic congestion and employee stress due to commuting and promoting use of new telecommunications and economic development in rural areas. Standard technology at most telework centers included telephones, computers and modem, printers, fax machines, and copy machines. Employees were very positive about their experiences; telework centers enhanced their productivity. Japanese workers experienced a greater sense of social isolation and difficulty in self-management. Self-reports consistently showed greater productivity. Remote work required new management attitudes and skills, such as skills related to setting clear performance and quality targets. Telework center use patterns appeared to reduce fuel consumption and traffic congestion. (Appendixes, amounting to over one-half of the report, include case studies of telework centers and resort offices, interview questions, and 32 references.) (YLB)

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Workscape 21

The Ecology of New Ways of Working

Telework Centers

An Evaluation of the North American and Japanese Experience

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And most of all many thanks to the users of the telework centers who gave their time and shared their enthusiasm for their new working practice.

Foreword

The International Workplace Studies Program, formerly the International Facility Management Program, is a research program based at Cornell University in Ithaca, New York. The program is supported by a consortium of private and public sector organizations in the United States, United Kingdom, Europe, and Japan, and was launched in 1989. The IWSP mission is to generate research-based information related to the planning, design, and management of facilities that can contribute to the development of more competitive and effective organizations.

Executive Summary

Introduction

Telework centers are being introduced in countries all over the world to address a number of key issues in organizations today. In California, USA, where commutes to work often force employees to begin their day in the very early hours of the morning (e.g., 3am), telework centers are being established to change travel patterns and help employees balance work and family life. In places like Vancouver, British Columbia and Tokyo, Japan, traffic and air quality issues are the primary driving forces behind the introduction of telework centers. Still other drivers, such as the ability for telecommunications companies to demonstrate new products and to model new work patterns, or to bring work to people in remote, rural areas, influence companies to begin using this type of workplace arrangement.

Report Goals

The purpose of our research and this report were to:

- Identify as many telework center sites as possible in North America and Japan.
- Develop a typology of telework centers and their variations.
- Describe in summary and case study form key characteristics of these sites, including their location, size and scope; driving forces; goals and objectives; nature of work and workers.
- Describe in summary and case study form the effects of working in telework centers on workers, coworkers, and supervisors based on a combination of our own and others' on-site observations, interviews and archival data.
- From these data identify what appear to be critical success factors.
- Examine the cost and space implications of telework centers.
- Examine the technology implications of telework centers.
- Identify factors that block the development of telework centers as a component of new ways of working.

Methodology

The specific research questions that were addressed in this report include:

- What is the impact of using telework centers on:
  - communication
  - work groups/departments
  - performance
  - supervision
  - travel/environment

  - type of work done in various locations?

- Are there differences between the effects that telework centers have on the above issues depending on whether the centers are single or multiple company centers?

- Are there differences between the effects that telework centers have on the above issues depending on whether the users are full-time or part-time?

Research Design

Ten telework centers and two resort offices were investigated in the United States, Canada, and Japan. A case study approach was utilized to analyze the key research questions at each of the sites. Sites were chosen to obtain a variety of telework centers according to differences in design, funding, and use; whether they were used as full- or part-time work locations, single company or multiple company sites, and/or whether they were funded by private organizations or by the government.

Data Collection

Three methods were used to collect data:

(1) A questionnaire was distributed to site administrators to provide background information necessary for the planning of the study.

(2) Interviews were conducted with office administrators, telework center users, their coworkers, and their supervisors.

(3) Archival data available at the centers was used to analyze use patterns.

Respondents were selected at random and confidentiality was assured.

Defining Telework Centers

For the purpose of this report, telework centers were defined as work locations used by firms to accommodate staff who live near the telework center locations. A primary component of this definition is that the telework center is located near the user's residences. Telework centers differ from "executive suite" type offices and branch offices that are established for a variety of business issues, none of which relate to employee residential proximity.

Single vs. Multiple Companies

A key difference between telework centers is whether they are occupied by single or multiple companies. Single company sites are typically owned or leased by the company occupying them. In many cases, the companies have turned surplus space in their existing facilities into a telework center. In other cases, companies have leased property outside of the city limits, perhaps in residential areas, that is less expensive than that in the city.

Multiple company telework centers—telework centers that are used by more than one company—may be governmentally driven or entrepreneurially driven (usually by developers). For the developer, the telework center may be a new use of property that might otherwise have low market potential. For the governmental agency the telework center is an attempt to encourage alternative travel patterns that would improve environmental quality by reducing traffic congestion and commuting.

Typology of Telework Centers

Many terms are used to describe telework centers such as neighborhood work centers, telebusiness centers, and telecottages. To some extent, these differences in nomenclature indicate the respective location of the facility (i.e., "neighborhood" refers to work centers in residential areas, "telebusiness" refers to work centers in business districts, etc.). For the most part, the different terms are simply names selected by organizations to describe their own projects rather than to denote any critical defining characteristics of the offices.

In order to clarify the various dimensions on which telework centers differed, we looked at use patterns, ownership and implementation, tenancy, and location of each site. Most telework centers examined were government-initiated multi-tenant sites. Use patterns varied anywhere from full-time use by employees to only one or two days a week.

Space Rental Patterns

Another way to classify telework centers among the selected sites was in terms of how space was leased to companies. In some cases workstations were leased on a monthly basis, whereas is other cases workstations were leased for a given number of days per month.

Driving Forces of Telework Centers

The telework centers we examined had both a set of *primary drivers* and a set of *secondary drivers*. In any specific instance some combination of primary and secondary drivers actually operated. Which individual factors were stressed by those involved in implementing or using telework centers varied.

Primary Drivers

The primary drivers we encountered for establishing telework centers included:

- transportation issues
- economic development
- marketing.

Secondary Drivers

The list of secondary drivers were so classified because these factors were not by themselves used to justify establishing telework centers. None of the secondary factors were the primary focus of the formal evaluation programs assessing pilot programs. The secondary drivers included:

- quality of life
- cost reduction
- better way of working
- disaster recovery

Disaster recovery was not a driver of any of the selected sites. It is listed above because the terrorist bombings in the City of London and in New York City's World Trade Towers in Spring 1993 created considerable interest in work decentralization as a strategy for reducing the disruption from such disasters; and thus, disaster recovery may become more of a driver over time.

Telework Centers: Goals and Objectives

A number of goals and objectives for telework centers were identified related to the drivers noted above. These included:

- Reducing traffic congestion, especially at peak travel periods.
- Reducing the length of commutes and therefore the amount of air pollution and energy consumption generated.
- Reducing employee stress related to commuting.
- Promoting the use of new telecommunications equipment and services.
- Promoting economic development in rural areas.

Supply vs. Demand Driven Telework Centers

What has not been characteristic of most telework centers established to date is a focus on new ways of working. This is true even of single site companies. Telework centers have been established for product marketing or to meet state and local air quality regulations. In effect, telework centers have been *supply* driven. The telework center site is established for the reasons noted above and then employees are asked to volunteer to work there. In none of the cases we have studied (or that have been documented) has the primary driving force been a corporate mandate to explore new ways of working, out of which telework centers emerged as one among many possible alternative work patterns. The absence of this *demand* driven model is one reason we belive that telework centers to date have been only marginally successful institutionally.

Methods of Evaluating Telework Centers

The nature of the performance measures for telework centers that have been have varied according to the original drivers of the project. In Southern California, the performance measures have centered around air pollution and transportation measures: number of trips per day, length and duration of commutes, and so on. To some extent, data has been collected on employee and supervisor attitudes towards the telework centers, but to the extent this has happened the focus has been primarily on individual satisfaction and productivity, rather on the impact to the organization as a whole.

One reason that organizations may not have assessed the impact of telework centers from an organizational perspective is that the number of employees involved in the projects to date has been very small. Telework participants are also often from different departments. The time and effort necessary to track these people and determine the impact of the telework centers on their performance, as well as on their coworkers, is a difficult process that few organizations have undertaken.

Telework Center Profile

Physical Description

The average distance from the normal office location was 63 miles in North America compared to 19 miles in Japan. The North American average was heavily influenced by the distances in Southern California, where daily commutes of 40-90 miles are not unusual.

The offices ranged in size from slightly under 2,000 s.f. to a little more than 8,000 s.f., with the typical office being about 2,000 s.f. Most telework centers were designed with an open office, although some of the centers had private or semi-private offices. Several of the telework centers provided conventional conference rooms, as well as break, and copy/fax areas.

Costs

The space costs were generally subsidized to the users through government grants and private sector donations. In multi-company sites rents ranged from $100 per month for rental of a workstation to no charge.

Technology

In addition to telephones (usually with e-mail and/or voice mail), the standard technology provided at most telework centers included PC computers and modem, printers, fax machines, and copy machines. The Japanese offices tended to have more sophisticated telecommunications equipment in them, including videoconferencing, videophones, large format fax machines, and high speed data transmission units.

Administration

Most of the centers had a full-time administrator. The administrator's responsibilities generally were to oversee the operation of the center, performing such duties as reconciling telephone bills, ordering supplies, monitoring use patterns, and handling inquiries about and visitors to the center.

Occupancy Patterns

The range of job types found at the telework centers included billing clerk, service representative, system analyst, computer programmer, production support, media relations coordinator, auditor, planner, and regional sales manager. Almost all users were professional staff as opposed to managers or supervisors, and the job functions were those that allowed a high degree of autonomy. In all of the cases users who volunteered to work in the telework centers had to seek permission from their immediate supervisor.

Two types of users existed at the facilities: full-time users and part-time users. *Full-time* users were expected to work in the telework center five days a week, only occasionally returning to the central office. *Part-time* users occupied the telework center from 1-2 days a week, with the remaining days scheduled at the central office. Users generally scheduled for the entire day at either the central office or the telework center, rather than working in both locations in a single day.

The percentage of available workstations and offices contracted in multi-company sites ranged from 45% to 70%. At the Japanese sites about 50% of the available workstations were reserved. A much lower percentage of contracted workstations and offices, though paid for by an organization, were actually used on a regular basis.

Summary of Findings

Performance and Communication

Our data indicated that employees using telework center facilities were very positive about their experiences with them, and that telework centers enhanced their productivity. Their managers generally concurred.

The improvement in self-reported productivity by employees was consistent across culture, the nature of tenancy, type of work, and telework center location. There were differences, however, among other issues related to the telework centers, centering primarily around users' connectivity with the organizations: social isolation, self management, and communication with the central office.

There was a greater sense of social isolation and difficulty in self-management among the Japanese workers than those in North America. While workers in both multi- and single-company sites reported generally high levels of satisfaction and enhanced individual productivity, observations and interviews suggested that in the North American single-company site which tended to have a high social density there was a greater sense of being connected to the company as a whole, and less concern about being out of touch with the central office. These findings did not seem to vary as a function of the job itself.

Effects on Transportation and Environmental Quality

North American telework center workers reported a significant decrease in mean travel times between their typical daily commute to a central office in comparison to the telework center. On average, there was an 86% savings in commute time, or about 76 minutes per day each way. Japanese telework center users saved about 25 minutes per day each way.

In California, where automobile traffic is measured in cold starts (the number of times a car is started with a cold engine), the telework centers have not helped the environmental problem. At the IEEP's Riverside Telecommuting Workcenter, for instance, 97% of users drove to the office alone. If these employees had participated in car pools to the central office, commuting to telework centers could actually increase the number of cold starts.

Discussion of Telework Centers

The following sections discuss some of the IWSP and other research findings on telework centers:

Impact on Productivity and Communication

Self-reports consistently showed that productivity was greatly enhanced as a result of working in a telework center. One can argue that this increase in productivity stemed from the fact that telework center users were in most cases selected based on their high level of performance in the central office; users were highly productive before they used the telework centers, therefore their productivity should generally appear higher than those who did not use the telework centers. There is evidence, however, that productivity increased for all users, both those workers that were already highly productive, and those that were less so before using the telework center.

While individual productivity increased for telework center users, productivity may have suffered somewhat for colleagues and coworkers who remained in the central office. These workers were forced to perform more activities that before were more evenly shared, things like answering telephone calls, mentoring, informal training and brainstorming. In addition, work practices such as informal work-related interaction and team support (i.e., team efficiency) seemed to have been more difficult to maintain as a result of key employees working remotely.

Impact on Supervision and Management

For any type of remote working to be successful requires new management attitudes and skills. Traditional supervisory patterns based on the ability of supervisors to visually see their staff working have little value in the context of telework.

Remote work requires clear performance objectives. This means a shift from an emphasis on "good citizenship" to an emphasis on what work is actually accomplished within a specified period of time and at a specified level of quality.

What this means for management is:

- Development of skills related to setting clear performance and quality targets.
- Learning how to use information technology like E-mail, voice mail, and fax effectively.
- Learning to structure one's own time more efficiently and effectively, as well as helping or providing resources and guidance to staff to do the same thing.
- Accepting that occasionally having staff work remotely will be inconvenient; but assessing this inconvenience within the frame of the overall effectiveness of the system.
- Taking the time and making the effort to understand how having some staff work remotely affects those not working remotely.
- Creating or inventing new policies and practices that protect the productivity and work loads of those not working remotely.
- Encouraging socializing and meetings between central and remote staff, not viewing this as wasted time or "goofing off."

Impact on Cost, Space and Design

Organizations and public/private sector partnerships implementing pilot studies should consider setting market conditions from the project's inception. While it may be more difficult to attract organizational support initially, establishing market conditions would create pressures for organizations to consider their workplace practices as an integrated system from the beginning.

Most telework center users occasionally return to the central office, often 2-3 times a week. Given the telework center workers' concerns about keeping in touch with coworkers and supervisor and with changes in work processes or procedures, much more attention should be paid to the design and use patterns of telework center workers when they return to the central office. One implication of this is that the conventional office design of workstations or enclosed offices needs to change to support more interaction and teamwork. Non-territorial offices, shared assigned offices, and other team-oriented designs in the central office may effectively support remote working more than traditional office designs, and at the same time reducing central office costs. These savins can be reinvested into new technology, more training, etc.

Impact on Technology

Technology above and beyond E-mail, voice mail, fax, and computers did not appear to make a significant difference in user acceptance or performance. Technology should be viewed as an "enabler" rather than an "inducer" technology enables the user to move among various settings over time, with information always being accessible via electronic highways, but does not necessarily instigate working remotely.

In no instances did either managers or staff mention concerns about the security of information. In part, this may be because in multi-tenant sites, companies sometimes installed their own computers, thus bypassing the problem of security on machines used by employees of different companies at different points in time.

For certain kinds of work wideband network capacity is essential. Without it, work is literally not possible. And regardless of what technology is provided, users must be trained in its use.

Several of the problems cited by users or their managers might be resolved with the advent of different technology or the better use of what already exists.

Impact on Transportation and Environmental Quality

The relatively rigid scheduling of telework center use, in which each employee works in the telework center on a specific scheduled day eliminated some of the flexibility in work patterns that telework might support. It also did not serve the need of workers whose jobs required them to be in and out of the office in unpredictable time patterns, for example people in sales, consulting, customer service, and project management.

Telework center use patterns appeared to reduce fuel consumption and traffic congestion. As a result of telework centers, people made fewer trips to the office and scheduled many of their trips during non-peak hours. Their impact on cold starts was unclear.

Untapped Areas: Impact on the Community

Neither this study, nor any others, have explored the effects of telework centers on the community. Telework centers, especially those located in the midst of residential development, will challenge current zoning practices and laws that have as their basic working assumption the desire to physically separate work and residential activity patterns. One positive implication of remote working on the community is the potential for neighborhood work centers or home-based telework, which keep adults in the community throughout the workday, to reduce crime and vandalism.

Untapped Areas: Impact on the Family

Our and others' data suggest that telework centers reduce stress related with long and difficult commutes. Teleworkers appreciate the opportunity to spend more, and better quality, time with their families. The intriguing question for telework centers is their potential to break the daily commuting cycle, and with it some of the alienation, anger, and frustration—and simple exhaustion—without bringing work directly into the home.

Conclusion

Telework centers work well from the both the perspective of those using them and those supervising telework center users. Yet neither the number of companies, nor the use patterns of individuals within them, has been high. Why, if telework centers work so well for staff and their managers, has this happened?

The answer lies, we think, in the failure to conceptualize telework centers from their inception as a new form of work which has the potential to combine cost savings with more productive and effective workers. Telework centers have been primarily viewed as a solution to problems associated with traffic congestion and air pollution, or as a way to demonstrate the value of new telecommunication technologies. In themselves, these goals are unlikely to generate enthusiasm or commitment on the part of senior managers and executives.

For the most part telework centers have been supply driven; that is, government and private sector partnerships have worked together to create new places for work, and then to tried to attract corporate users to occupy them. Rarely has the primary justification of telework centers been to help the organization survive in a competitive economic climate.

In many cases telework center users have retained their assigned workstations in the central office, resulting in increased organizational costs for both space and technology. In no cases have home-based telecommuting, telework centers and the central office been developed as a single, integrated workplace strategy.

The data we and others have collected on telework centers suggests that for telework centers, neighborhood work centers, and other forms of telework to be accepted by organizations, a range of issues need to be addressed. These include:

- Training of staff and management in how to get the most value out of information technology that exists.

- Understanding how new work patterns may undermine subtle but tremendously valuable work practices, such as informal mentoring and on-the-job training.

- Inventing new policies and practices that compensate for valuable work patterns and practices that may be lost with the advent of new working practices.

- Conceptualizing the telework center or other forms of telework as part of an integrated workplace system so that effects are examined system wide, not at only one point in the system.

- Costs need to be assessed in relation to the organizational system as a whole, not just to the space costs in a particular department or division.

- The goal of improving air quality needs to be viewed as an outcome of adopting a range of new working practices, which in combination change where, how often, how long it takes, and in what manner we get to work.

- We need to understand what kinds of jobs—or what aspects of different jobs—could be done in telework centers and other locations remote from the central office.

- We need to separate fact from fiction in terms of what goes on in the central office today.

The fact that few organizations have addressed, let alone resolved these issues, helps explain why telework centers have not been as successful as one might expect. In effect, few organizations today have the combination of management skills and practices, training programs, and technological sophistication to exploit the potential advantages of telework centers To reap the full benefits, organizations will need to:

- Change management styles and beliefs, especially about the possibility of remote supervision.

- Change central office design to reflect less intense occupancy patterns and to support more interaction among those people in the office on any given day.

- Rethink how workloads are assigned and distributed, and ways to make these dynamic.

- Devote more time and thought to formal training programs, and informal mentoring and colleague-driven on-the-job training.

- Provide new telecommunications technologies and help people learn how to use them to their full potential.

- Generate results-oriented performance assessment programs.

Until such organizational change occurs, the marginal benefit of higher productivity of a very small number of employees working more productively at telework centers is likely to be dwarfed by the perceived costs of the organization adopting a new organizational paradigm.

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Introduction

The Longest Day

The day began at 3 am for Marsha, long before daylight streaked the horizon. With the ringing of the alarm came the groan and grim determination to face another day. After dressing and a cup of coffee, Megin, four years old, had to be scooped from bed and taken to the car. A short drive to Shirley's, a neighbor, and Megin was back in a different but familiar bed, knowing what was happening but too sleepy to pay much attention. Marsha climbed back into the car and drove to the parking lot near the bus station. Two hours later she arrived at work. Then, at the end of the day, like a bad rerun, the journey would be repeated. Every day of the week. In the meantime, at 6 am Shirley woke up Megin again, got her dressed, and took her to a second neighbor, Jenneka, who took care of her until 8 am, at which time she was trundled off to the day care home. At 6 pm she was picked up, and stayed with Jenneka until 7:30 pm when Marsha came to collect her.

It had been a long day, just as it was every day of the week. The statistics capture the worst of the consequences. Palmdale, a sprawling community in the desert east of Los Angeles, has the highest child abuse rate in Los Angeles county. Exhausted and stressed parents and children, beaten down by ungodly hours and long commutes, are not the parents or the children they might be.

For people like Marsha the opportunity to live and work in the same community is the difference between a reasonable life and grinding existence. The Telebusiness Center where Marsha now works two days a week is the lifeline that permits her to lead a reasonable life. Like a number of other "telebusiness centers" established in Southern California over the past three years by a combination of government grants and private sector support, California telework centers seek to change travel patterns. If they are successful, in the process they will transform how we work and, ultimately, how we live.

A thousand miles north, in Vancouver, British Columbia and three thousand miles west, in Tokyo, traffic and air quality are the primary issues influencing the creation of telework centers, but there are other issues as well. Telecommunications firms like NTT and BC Tel are in the business of selling telecommunications equipment and services. For these companies telebusiness centers are intended to demonstrate new products and to model work patterns that would encourage their customers to adopt similar work patterns—and the new technologies and services on which many of these are founded.

In still other locations, like rural Kentucky, Finland, and England, "telecottages" have almost nothing to do with traffic issues, and everything to do with economic development. The goal is to bring the work to people in remote hamlets so that securing a livelihood does not require uprooting family and abandoning communities that once survived on lumber, sheep, coal, or ship building.

Report Goals

This project focused on increasing our understand of telework centers and their impact in North America and Japan. These two locations were chosen because most of the telework centers that have been established are in these locations.

The purpose of our research and this report were to:

- Identify as many telework center sites as possible in North America and Japan.[1]
- Develop a typology of telework centers and their variations.
- Describe in summary and case study form key characteristics of these sites, including their location, size and scope; driving forces; goals and objectives; nature of work and workers.
- Describe in summary and case study form the effects of working in telework centers on workers, coworkers, and supervisors based on a

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[1] Over the course of our research new sites have continually appeared. A number of the sites are briefly summarized in Appendix B: Supplemental Case Studies of Telework Centers.

combination of our own and others' on-site observations, interviews and archival data.

- From these data identify what appear to be critical success factors.

- Examine the cost and space implications of telework centers.

- Examine the technology implications of telework centers.

- Identify factors that block the development of telework centers as a component of new ways of working.

To a certain extent, our research efforts were limited by the fact that there were very few telework centers in North America, Japan, and Europe, and that the number of employees using the telework centers tended to be fairly small. In addition, few, if any, of the sites were developed as part of a company-wide strategic effort to rethink conventional work patterns and practices (including organizational culture and the nature of supervision). The lack of such a strategic effort made it difficult to investigate the actual impact on the organization as a whole.

It is important to identify those areas in which neither our or any others' data collection efforts have focused. These include, most significantly, the implications telework centers might have on the family and the community. Some conjecture about what these implications might be, and their potential as future areas of study, are discussed at the end of the report.

Equally important, while this report mentions some of the traffic and air pollution implications of telework centers, that was not a focus of our own data collection efforts.

Methodology

Specific Research Questions

The specific research questions that were addressed in this report included :

- What is the impact of using telework centers on:
    - communication
    - work groups/departments
    - performance
    - supervision
    - travel/environment
    - type of work done in various locations?

- Are there differences between the effects that telework centers have on the above issues depending on whether the centers are single or multiple company centers?

- Are there differences between the effects that telework centers have on the above issues depending on whether the users are full-time or part-time?

Research Design

These research questions were investigated at ten telework centers and two resort offices in the United States, Canada, and Japan. Five of the ten telework centers were located outside of Los Angeles, one was located outside of Vancouver, and four were located outside of Tokyo. Both of the resort offices were in Japan.

These sites differed from each other greatly in their design, funding, and use: five of the offices were full-time work locations for a single company; four of the offices were primarily part-time locations for use by multiple companies; and one of the offices was flexible in terms of user scheduling for multiple companies (see Table 1: Research Sites by Use Pattern and Type of Occupancy).

Table 1: Research Sites by Use Patterns and Type of Occupancy

		Type of Occupancy	
		Single Tenant	**Multiple Tenants***
Use Patterns	**Full-Time**	BC Tel Langley Fuji Xerox NTT Ageo NTT Funabashi NTT Kamakura	IEEP Apple Valley IEEP Ontario IEEP Riverside LA County Antelope Valley
	Part-Time/ Assigned Days		IEEP Apple Valley IEEP Ontario IEEP Riverside LA County Antelope Valley
	Flexible Usage		IEEP East Highland

* The multiple tenant telework centers had both full-time and part-time users according to the individual company policy.

Other offices we have found were located outside of New York City and Washington, D.C., in Northern and Southern California, and Hawaii. Descriptions of these telework centers can be found in Appendix B: Supplemental Case Studies of Telework Centers.

Selection of Sites

Our goal for selecting the various sites centered around the premise that we wanted to assess telework centers that varied as a function of use pattern, national context, and the nature of their tenancy. Sites were also selected based on our ability to gain access to them.

Selection of Respondents

Telework center users were randomly asked to participate in focused interviews based on who was available on the day(s) of the visit(s) to the individual centers. Confidentiality was assured. At the end of the interview, users were asked if they had any objection to our contacting their manager and coworkers to discuss these issues with them. Of the 38 users who were interviewed, only one of them had objections to our contacting his supervisor. The one objection occurred when the user felt his manager was unhappy about his using the office and did not want the manager to be involved with the office any more than he already was.

The individual interviews were approximately 20-30 minutes in duration.

Table 2: Number of Interview Subjects

	Canada	United States					Japan			
Organization	BC Tel	Inland Empire Economic Partnership (IEEP)				Los Angeles County	NTT			Fuji Xerox
Site location	Langley, British Columbia	Ontario, California	Apple Valley, California	East Highland Ranch, California	Riverside, California	Antelope Valley, California	Funabashi, Japan	Kamakura, Japan	Ageo, Japan	Musashino, Japan
# people interviewed	1 admin. 12 users 3 sup. 4 co-wks	1 admin. 7 users 3 sup. 2 co-wks	1 admin. 3 users	1 admin. 2 users	1 admin. 4 users	1 admin. 7 users 3 sup.	3 admin.	2 admin.	2 admin.	3 admin. 3 users inc. 1 user/sup.

The number of users available at each the telework centers was very low. Table 2 shows for the number of people interviewed at each site. There were no refusals to be interviewed.

Data Collection

Three methods were used to collect data:

(1) A questionnaire was distributed to site administrators to provide background information necessary for the planning of the study.

Whenever possible, a questionnaire was distributed ahead of time to the administrator or manager of the office. This questionnaire asked only basic information about the office (such as number of users from each company) to provide background information to help better plan the study.

(2) Interviews were conducted with office administrators, telework center users, their coworkers, and their supervisors.

Interviews with the office administrator and the office manager (where available) focused on specific information about the office, policy information, use information, equipment details, funding, costs, and goals.

Interviews with the office users pertained to the users' time activity patterns, communication patterns, performance evaluation, and travel patterns. They also explored how using the telework center affected their colleagues and group (see Appendix D: Key Questions of the Telework Center Survey).

Interviews with the coworkers and supervisors of the telework center users examined the effects of telework centers on communication patterns, individual and group effectiveness, and (supervisor only) the telework center user's performance(see Appendix D: Key Questions of the Telework Center Survey).

(3) Archival data available at the centers was used to analyze use patterns.

Whenever possible, archival data was obtained from the telework centers or the companies to help determine when users were working at the telework centers.

Defining Telework Centers

For the purpose of this report, telework centers were defined as work locations used by firms to accommodate staff who live near the telework center location. Use patterns varied. They ranged from employees having 1-2 full-time days a week scheduled, to full-time use every day, to variable use on an unpredictable schedule. Those occupying them, even if from the same company, were often organizationally independent; that is, they were not from the same department, project or task team.

Thus the primary requirement of a telework center is that the person using it live near it and be a member of a firm that has offices in other locations.

This definition distinguishes telework centers from "executive suite" type offices that (at least until recently) have been marketed to and used primarily by individual entrepreneurs or professionals who want a well-equipped and staffed office as an alternative to working at or from home; very small firms that want a full range of services and technologies that could not be afforded if purchased for sole use; or small outposts of large firms who occupy space on a short-term basis while establishing a foothold in a new area or as transition space while more permanent space is prepared. In all these cases residential proximity has little or nothing to do with the choice to occupy the space. They also differ from the conventional branch office in which people from the same department work together in a small regional or area office even though they may live outside the area where the branch office is located.

Single vs. Multiple Companies

A major distinguishing feature of telework centers is whether or not they are occupied by single or multiple companies. Single company sites are typically owned or leased by the company occupying them; for example, BCTel in Vancouver, British Columbia, NTT and Fuji Xerox in Japan. In the case of the telecommunications firms, the drastic reduction in the size of branch telephone exchanges—from whole floors of a small building to essentially the size of a large closet—has made owned space (which would otherwise become surplus space) available in residential locations for alternative uses. When combined with the concept of a "living showroom" in which new telecommunications products and services intended to facilitate work from remote locations can be demonstrated in-use to potential customers, single companies have found it worthwhile to convert the space to a telework center. The public relations value as a caring employer and firm concerned about both staff welfare and environmental quality makes such arrangements yet more attractive.

Multiple company telework centers may be governmentally driven, as they have been in Southern California, or entrepreneurially driven (usually by developers). The two motivations are different, although the outcomes and goals share much in common. For the developer, the telework center may be a new use of property that might otherwise have low market potential. For the governmental agency (in partnership with private firms) the telework center is an attempt to encourage alternative travel patterns that would improve environmental quality by reducing traffic congestion and commuting.

Telework Center Glossary

Telework Center:	The generic term used by the Cornell University International Workplace Studies Program to describe small sites typically located away from major cities and close to residential neighborhoods.
Telework Center:	A term used in Japan and by some North American companies to describe their telework centers some of which are located in urban areas.
Telebusiness Center:	A term developed by the Inland Empire Economic Partnership (formerly the Inland Empire Economic Council) to describe multi-tenancy office facilities located in greenfield business parks, commercial strip malls, and residential developments.
Neighborhood Work Center:	This term was first used by the Swedish Center for Working Life to describe experimental multi-tenancy facilities intended for use by people living close to them.
Telecottage:	This term is used in Great Britain to describe facilities located in rural areas. The intent is to bring the work to the workers electronically, and in the process to stimulate economic development of rural areas and to stop the flow of people into cities. Typically, companies with major operations in cities send data to be processed to these remote sites. Job training and retraining for local citizens is a major goal.
Executive Suites:	This term, is used generically to describe small offices, typically of a 1000 s.f. or less, that are leased to individual entrepreneurs and professionals, to small firms who desire a more extensive range of services and equipment than can be economically justified, or to individuals and small groups from large firms who need temporary office accommodation.

Figure 1: Telework center glossary

Typology of Telework Centers

Figure 1 is a glossary of terms used to describe telework centers. The terms seem to suggest differences in location (e.g., neighborhood work centers are located in a residential area; telebusiness centers are located in a greenfield business park or strip commercial development; telecottages are located in rural hamlets). For the most part, however, the different terms simply reflect a nomenclature given by local sites to their own projects rather than any critical defining characteristics of the offices themselves.

A starting point in trying to understand the role that telework centers might play as an alternative to a conventional headquarters, regional, or branch office was the development of a typology that could help us understand the various dimensions on which telework centers differed. In particular, we looked at use patterns, ownership and implementation, tenancy, and location. Table 3 arrays a number of different telework center sites along two dimensions: *type of occupancy* (single vs. multiple tenant) and *use patterns* (full-time; part-time, assigned days; flexible usage). Table 3 shows that most telework centers examined to date are multi-tenant sites, that all of these are government initiated, and that they are about evenly split in terms of use pattern between those used full-time on a partial week basis by an individual employee and those used full-time every day of the week by the same employee. In only one case was the predominant pattern variable time of the days and weeks. In that instance, East Highland Ranch in Southern California, the telework center was, in fact, operating much like an executive suite.

Space Rental Patterns

Another way to classify telework centers is in terms of how space is leased to companies. In some cases workstations were leased on a monthly basis, whereas is other cases workstations were leased for a given number of days per month. Each workstation leased on a monthly basis, as with the Inland Empire Economic Partnership (IEEP) sites in Southern California, was often assigned by the company to

Table 3: Typology of Telework Centers[2]

		Type of Occupancy	
		Single Tenant	**Multiple Tenants**
Use Patterns	**Full-time**	BC Tel Langley Δ Fuji Xerox Δ NTT Ageo Δ NTT Funabashi Δ NTT Kamakura Δ	IEEP Apple Valley § IEEP Ontario § IEEP Riverside § LA County Antelope Valley §
	Part-time/ Assigned Days	*NY Telephone Mineola* Δ *Pac Bell North Hollywood* Δ *Pac Bell San Francisco* Δ	*GSA Winchester* § *GSA Hagerstown* § *Hawaii Telework Center* § IEEP Apple Valley § IEEP Ontario § IEEP Riverside § LA County Antelope Valley § *Pac Bell & MTA Concord* § *Pac Bell & MTA San Jose* §
	Flexible Usage	*Pac Bell North Hollywood* Δ *Pac Bell San Francisco* Δ	*Hawaii Telework Center* § IEEP East Highland §

Key: Δ=Company Initiated *Italics*= Supplemental Case Studies

§=Government Initiated

several different employees, with each employee working on a predetermined day of the week. Or, if the same employee was expected to work in the telework center every day of the week, the workstation would be assigned individually.

In the case of workstations leased to a given company for a specified days each month (e.g., Antelope Valley in Southern California) the workstations were often assigned to the same individual if that person used the office every day of the week. If a workstation was used by more than one person, then a company only rented the workstation for the specific days that it would be used. The workstations could also be rented out to one or more companies on the other days. For example, Company A could rent workstation 5 on Monday and Wednesday, which allows Company B to rent workstation 5 on Tuesday, and Company C to rent it on Thursday and Friday. This system benefits the individual companies that only require a workstation or office a few days a week because it does not charge them for unused time. It benefits the provider since more companies can lease space than there are workstations, thus ensuring better utilization.

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[2] Two telework centers have been left off of the chart because they do not have any tenants and therefore can't be categorized. These centers are the Simi Valley TMA Neighborhood Telecommuting Center and Global Telematics' Ballard Telework Center (see Appendix B: Supplemental Case Studies of Telework Centers).

Driving Forces of Telework Centers

Like most innovations, telework centers have a set of *primary drivers* and a set of *secondary drivers*. Typically, in any specific instance some combination of primary and secondary drivers actually operate. Which individual factors are stressed by those involved in implementing or using telework centers typically varies.

Primary Drivers

The primary drivers we encountered for establishing telework centers included:

- transportation issues
- economic development
- marketing.

Secondary Drivers

The rationale for classifying the factors below as secondary drivers stems from, first, the fact that in contrast to the primary factors, these factors have not by themselves been used to justify establishing telework centers. Secondly, none of the factors have been the primary focus of the formal evaluation programs assessing pilot programs. Were they primary, it is assumed they would have been a major component of formal evaluation programs. The secondary drivers include:

- quality of life
- cost reduction
- better way of working
- disaster recovery.

Disaster recovery, the last point noted above, has not, in fact, been a driver to date. It is listed above because the terrorist bombings in the City of London (the financial district) and in New York City's World Trade Towers in Spring 1993, both of which caused massive damage and disruption of work activities, created considerable interest in work decentralization as a strategy for reducing the disruption from such disasters. Thus, disaster recovery has the potential to become a secondary driver.

Photo 1: Exterior of Ontario telework center, located 2 minutes from a major freeway

Photo 2: Exterior of Apple Valley telework center located in a strip mall

Telework Centers: Goals and Objectives

A number of goals and objectives for telework centers can be identified related to the drivers noted above. These include:

- Reducing traffic congestion, especially at peak travel periods.
- Reducing the length of commutes and therefore the amount of air pollution and energy consumption generated.
- Reducing employee stress related to commuting.
- Promoting the use of new telecommunications equipment and services.
- Promoting economic development in rural areas.

Supply vs. Demand Driven Telework Centers

What has not been characteristic of most telework centers established to date is a focus on new ways of working. This is true even of single site companies. They too, have established telework centers for product marketing or to meet state and local air quality regulations. In effect, whether multi-company or single company, telework centers have been *supply* driven. The telework center site is established for the reasons noted above and then employees are asked to volunteer to work there. In none of the cases we have studied (or that have been documented) has the primary driving force been a corporate mandate to explore new ways of working, out of which telework centers emerged as one among many possible alternative work patterns. The absence of this *demand* driven model is one reason, we will argue later, that telework centers to date have been only marginally successful institutionally, even while highly successful from the viewpoint of the individual employee and, to a somewhat lesser extent, the immediate supervisor.

Methods of Evaluating Telework Centers

Not surprisingly, which goals are emphasized in marketing telework centers to date depends on the original drivers. So, too, does the focus of telework center evaluation. In many cases telework centers have originated as formal pilot programs, whether multi-company or single company, government or private sector driven. As pilot programs, there are typically explicit termination dates for the pilot, and some corporate or governmentally mandated evaluation program to assess its "success."

In Southern California, where the telebusiness centers have been stimulated by government funding from air pollution and transportation agencies, the primary focus of the formal evaluations has been on traffic related measurement: number of trips per day, length and duration of commutes, and so on. Data has also been collected on employee and supervisor attitudes, but the fundamental concern in these government initiated pilots has been transportation demand and air quality. Attention has been paid to how working in telework centers affects employees and supervisors. The focus has been on individual outcomes, however, rather than the collective impact on the organization. In effect, none of the studies to date has asked, "How does the opportunity to work in telework centers affect the competitive position of the participating company?"

This is, of course, a difficult question to answer in any case. Because the pilot programs are so small, often involving only a handful of employees who are typically from different departments, the ability to draw any firm conclusions is further compounded. Nonetheless, the fact that the pilot programs are not set up to test this proposition underscores the failure of both providers and users of telework centers to conceive, from the inception, telework centers not as a transportation or workstyle issue, but as an opportunity to fundamentally challenge and transform existing work patterns and practices.

Telework Center Profile

Table 4 compares all the telework center research sites on a number of dimensions, each of which is described below.

Physical Description

The telework centers studied for this report were located from 20 to 90 miles from the users' normal office location. The combined average distance from the normal office location for all sites was 48 miles, although the average distance in North America was much greater than that in Japan; 63 miles in North America compared to 19 miles in Japan. The North American average was heavily influenced by the distances in Southern California, where daily commutes of from 40-90 miles are not unusual (see Table 4).

All of the telework centers examined resembled conventional office environments (See Photo 3-5). Table 4 shows that the offices ranged in size from slightly under 2,000 s.f. to a little more than 8,000 s.f., with the typical office being about 2,000 s.f. Open plan workstations are the rule (see Table 4). The two exceptions are in Riverside, California where there were 19 closed rooms, each with 2-4 desks in them used by members of the same company; and in Antelope Valley, where there were five private offices.

Several of the telework centers provided conventional conference rooms, as well as break, and copy/fax areas (see Photos 7, 8). While Japanese telework centers resembled conventional offices, an important goal was improving the quality of the office environment. To do so the Japanese offices had created a distinctly higher grade office environment than is found in most typical Japanese central offices. This improved office environment was accomplished not only with more amenities (including floral arrangements in the bathrooms and the provision of sophisticated exercise equipment), but also by simply providing much more space per person than found in the typical Japanese office (see Photos 5-7).

Photo 3: Interior of Ontario telework center

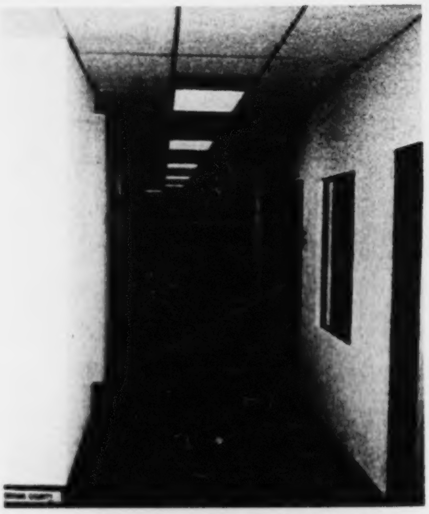

Photo 4: Interior of Riverside telework center, all private offices

Photo 5: Interior Funabashi telework center

Table 4: Comparison of Telework Center Research Sites

	Canada	**United States**					**Japan**			
Organization	BC Tel	Inland Empire Economic Partnership (IEEP)				Los Angeles County	NTT			Fuji Xerox
Site location	Langley, British Columbia	Ontario, California	Apple Valley, California	East Highland Ranch, California	Riverside, California	Antelope Valley, California	Funabashi, Japan	Kamakura, Japan	Ageo, Japan	Musashino, Japan
Distance from users normal commuting location	20 miles	40 miles	89 miles	76 miles	64 miles	87 miles	9 miles	31 miles	19 miles	varies
Time from telework center to normal commuting location in rush hr.[3]	80 min.	75 min.	60 min.	100 min.	87 min.	75 min.	40 min.	65 min.	55 min.	60 min.
Number of workstations/office	20 ws	24 ws	12 ws	6 ws (with a max. of 12 ws)	19 offices with 2-4 desks ea. plus room for 20 ws	5 offices and 15 ws	14 ws	12 ws	25 ws	17 ws including 3 for temporary workers
Office size	3,000 sf	4,300 sf	2,065 sf	1,700 sf	8,100 sf	approx. 2,500 sf	2,152 sf	1,722 sf	4,089 sf	5,122
Square feet/workstation or office	150 sf	179 sf	172 sf	283 sf (142 sf w/ 12 ws)	116 sf	125 sf	154 sf	144 sf	164 sf	301 sf
Date implemented	October 1991	October 1991	October 1991	October 1992	November 1991	January 1993	April 1991	June 1991	May 1991	October 1988
Pilot,/end date	No	Yes, 10/93	Yes, 10/93	Yes, 10/93	Yes, 10/93	Yes, 1/94	Yes, 4/94	Yes, 4/94	Yes, 4/94	No
Number of users	14 users	39 users	14 users	4 users	44 users	28 users	not available	not available	not available	10 users
Percent assigned	70% (14 ws)[4]	62.5% (15 ws)	66.7% (8 ws)	66.7% (4 users)	45% of offices (9 offices) and no ws	70% (70 slots)	37.7% (20 ws)			47% not including drop in areas
Percent of assigned used	n/a-full-time	25.1%	44.4%	50%	13%	60.6%	n/a-full-time			n/a-full-time
Percent of total used	n/a-full-time	15.7%	29.6	33.3 %	8% (w/ capacity of 70)	33.3%	n/a-full-time			n/a-full-time
# users day of site visit	10/day for 2 visits	3/day for 2 days	4	2	2/day on 2 visits	5/day on 2 visits	2	1	5	6

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[3] For the offices in Japan, the time is the Tokyo Station. It should be assumed that users work within 30 minutes of the telework center.

[4] The BC Tel recently removed the conference area from the office and added five additional workstations. At the time of the visit they were in the process of locating additional users for the office.

On the whole, however, neither the North American nor Japanese offices made any attempt to fundamentally change the way in which people worked while in the setting. None of the telework centers, for example, provided a wide range of workstyle options like those found in Finland and Sweden (Becker et al, 1990; Becker et al, 1993). When one realizes that telework center users are linked by their common residential location, not their organizational ties, it is easy to understand why designs promoting teamwork would be rare. There is no inherent reason, however, why office designs that support a diversity of workstyles and patterns could not be put in place.

Cost

In general, the space costs were highly subsidized to the users because most of the study sites were pilot projects supported by government grants and private sector donations. In multi-company sites like those managed by the IEEP, for example, rents ranged from $100 per month for rental of a workstation including the PC, printer, and modem to no charge at Antelope Valley. A report on the Washington State Employment Office Puget Sound pilot project helps put the extent of the typical subsidy in perspective. In the *Puget Sound* project employers paid about $1,500 per year to rent a work station in the telework center, which was a subsidized cost. The non-subsidized cost would have been about $9,000 per year including set up costs (Quaid and Lagerberg, 1992).

The rationale given by the organizations providing the telework centers for the very low or even free rents was that they believed removing cost as an issue would help attract organizations that might otherwise be reluctant to experiment with a new way of working. The evidence from the actual participation rates, which were low, (see Table 4) suggests that this strategy only partially succeeded. Yet based on the fact that at the end of the pilot projects, when government subsidies ended, many companies discontinued their participation all together suggests that cost was one factor influencing a company's commitment to telework centers. However, it cannot by itself account for low levels of participation since the costs to companies in many of the multi-

Photo 6: Bathroom floral arrangement

Photo 7: Japanese conference room with video teleconferencing

Photo 8: Riverside break room

company sites were minimal or non-existent, and yet commitment and use was consistently low.

Even in single company sites, like those in Japan, actual use patterns were low, often with about 50% of the available workstations reserved, and only about 30% of these used on any particular day. In these cases the space costs were marginal since the company owned the space already. It had adapted as office space what had become surplus with the drastic reduction in the size of the telephone switches that were previously housed in it.

Technology

Table 5 compares the technology available across the study sites. In addition to telephones (usually with e-mail and/or voice mail), the standard technology provided at most telework centers included PC computers and modem, printers, fax machines, and copy machines. The Japanese offices, several of which were run by telecommunications and computer companies, tended to have more sophisticated telecommunications equipment in them, including state of the art videoconferencing, videophones, large format fax machines, and high speed data transmission units.

Each workstation at NTT's Funabashi telework center, for example, was equipped with a networked high quality PC and a small (approximately 8") LCD color television. This small TV enabled employees to watch the network news and was also linked into the cameras at the central office via a system called "Tele-eye," which allowed the users to see their workgroups. This office was equipped with an ISDN system (INSnet1500) running at 1.5mb/s which allowed real time voice and full motion picture transmission. The high bandwidth video phone with a removable camera and color LCD display could send and receive voice and video concurrently. The camera was removable so that it could be focused on a document or computer screen to illustrate graphs, photos, etc. A Floppy Disk Transfer system that operated over the ISDN network quickly transferred complete floppy disks from one location to another. A user inserted their floppy disk into the machine at one location, entered a phone number and the recipients code, and the machine quickly and accurately sent an exact replica of the disk to the recipients machine, where it was held on a hard drive until the recipient picked it up.

Most of the computer equipment provided at North American sites was MS-DOS (IBM) based. In a few sites, such as Antelope Valley, both Apple Macintosh computers and IBM equipment (or compatibles) were provided so users had a choice. Those companies using the offices on a regular basis, however, most often provided their own computer equipment. Employees were familiar with their own company's computer system and software (including how it was formatted and the programs available), and information on provided equipment was more secure.

The number and range of software programs provided by the sites themselves varied. At only one site, Antelope Valley, did the administrator make an attempt to supply users with whatever software programs they requested. Approximately half of the sites had a LAN to connect workstations within the same office.

Thus the technology varied enormously in quantity, variety and sophistication. As noted below, this did not seem to have a significant effect on use patterns, or even overall satisfaction working in a telework center. A review of the other research that has been completed on telework centers reveals that technology has not played a very important role in the functioning of the offices. BC Tel, for example, made a point of not supplying different equipment from what is available in the central office (Rao, 1992). The IEEP found that all of the technology supplied was only used occasionally by the users. Telephones and computers were the staples of the users. Voice mail, electronic mail, and on line computing were, at least in our case study sites, less fundamental.

Administration

With the exception of BC Tel in Vancouver, Canada, in which the office's administration was handled by the users themselves on a three month rotation, most of the centers had a full-time administrator. The

Table 5: Comparison of Telework Center Technology by Continent

Japan	North America
Telephones	Telephones
Computers	Computers
Printers	Printers
Modems	Modems
Voice Mail	Voice Mail
E-Mail	E-Mail
Copier	Copier
Fax	Fax
LAN	LAN
TV & VCR	TV & VCR
Video Teleconferencing	Video Teleconferencing
Videophones	
Picture Mail	
Printing White Boards	
Collaborative White Boards	
Large Format Faxes	
Flat Monitors	
High Speed Floppy Disk Transfer	

administrator's responsibilities generally were to oversee the operation of the center. In the Southern California sites this took the form of reconciling telephone bills (each user was charged for the calls actually made), ordering supplies, monitoring use patterns, and handling inquiries about and visitors to the center.

User-oriented administrative services were minimal at all the sites. These ranged from no secretarial or receptionist services at the North American sites, to the provision of such services on a minor, restricted level in Japan. At the Southern California sites the administrators provided minor computer and printer technical support.

None of the administrators viewed, or had transformed, their role from operations or support to one of broader management in which, for example, an attempt was made to consciously create or encourage a particular culture or set of values governing how people worked or interacted with or used the space. This is understandable since none of the administrators had been given authority or a mandate to manage the centers in such a way. In fact, in a multi-company site such actions might be construed as interfering with individual company and employee prerogatives. The end result, however, particularly in the multi-company sites and to some extent even in the single company sites in Japan, was a sense of social isolation and disconnectedness among telework center users. Working in the telework center was more like spending time in an impersonal hotel than in a friendly club. Yet for some, as noted below, the opportunity to avoid—for a day or two a week—the social chatter of the office was a welcome relief.

Occupancy Patterns

A wide range of job functions occurred in the telework centers, these included billing clerk, service representative, system analyst, computer programmer, production support, media relations coordinator, auditor, planner, and regional sales manager. Almost all users were professional staff as opposed to managers or supervisors, and the job functions were those that allowed a high degree of autonomy. In all of the cases users who volunteered to work in the telework centers had to seek permission from their immediate supervisor. The ability to work independently and to be a highly motivated "self-starter" were personal qualities managers considered critical, in addition to the work itself not requiring continuous feedback and interaction with colleagues.

As noted in the discussion about telework center typology, there were two distinct use patterns. *Full-time* users were expected to work in the telework center five days a week, only occasionally (from 1-2 days a week to a few times a month or less) returning to the central office, and not necessarily for a full day. *Part-time* users occupied the telework center from 1-2 days a week, with the remaining days regularly scheduled at the central office. In both cases (full and part-time) the users generally scheduled their telework center days for the whole day. This practice resulted in predictable, rather than serendipitous—the employees dropping in whenever and for as long as they felt necessary—use of the centers. In part this had to do, especially in Southern California, with air quality regulations which are intended to reduce the number of cold starts for autos (the number of times the car is turned on and off) and not just the driving time or distance. Were employees to drop in and out of the telework centers, the number of cold starts might actually increase over normal commutes: hence, for firms trying to comply with government air quality regulations, specific days in which the employee arrives and departs only once in a day made sense.

As Table 4 shows, the percentage of workstations and offices actually contracted in multi-company sites ranged from a high of 70% at Antelope Valley to a low of 45% at Riverside. At the Japanese sites about 50% of the available workstations were reserved. These figures are misleading, however, since a much lower percentage of contracted workstations and offices were actually used regularly. Across most of the Southern California multi-company sites, for example, the average number of users reported during a day was only about 3-4. This represents at best a 50% utilization rate among part-time users, with a range from 13-50%. Even at Riverside, which had the largest number of scheduled users (44), only about 6 users were reported in the office daily. And in Japan, about a 30% actual occupancy rate (of the 50% of workstations allocated) was typical.

Conference Room Use

Conference rooms were an interesting special case in the Southern California sites. At the Ontario site, the conference room was used an average of 21 times per month (with a range from 8-33), and the average size meeting involved about seven people. At Apple Valley the conference room was used about four times a month, the average meeting involving three people. This later use pattern was similar to that at Antelope Valley as well.

The differences in use patterns between the two sites can be traced, in part, to the location of the offices. The Ontario site is located in a new mid-rise office tower off a major east-west freeway. The other two Southern California sites were located in small towns that were not located near any major highways. The Ontario telework center enabled companies to hold meetings with people who would otherwise have to travel considerable distances to meet.

The data suggests that conference rooms are not of great value for meetings of telework center users themselves. The evidence from Ontario, located on a major auto route, would suggest that this kind of facility is valued primarily for its location, then for its conference facilities. Given that most of the work done in the telework centers was highly independent and that there was minimal connection among those occupying the space (in single or multi-company sites), the value of conventional conference rooms for telework center users seems doubtful. BC Tel went so far as to remove their underutilized conference facility at their telework center and replaced it with additional workstations.

It is difficult to determine if this conjecture appears to hold true for Japanese telework centers as well. because of the differences in technology available. The conference rooms in the Japanese telework centers, most of which were equipped with videoconferencing, were used relatively frequently. However, the conference rooms were used primarily for their videoconferencing capabilities; telework center users utilized the videoconferencing equipment to communicate with colleagues at a central office. With no use charge connected, it was easy to use the facilities as opposed to driving back to the central office. It would be interesting to see if the utilization of the conference facilities changed as a result of instituting a fee for using the videoconferencing facilities. If it were more costly to use the videoconferencing equipment, it is very likely that utilization of the conference rooms would decreased.

Telework Center Users

The following kinds of issues concerning telework center users were addressed in our examination of telework centers:

- Work/task performance.
- Communication with coworkers and clients outside the telework center.
- Satisfaction with overall arrangement (among users, coworkers, and managers).
- Social and organizational "connectivity."

Work Performance

Telework center users' self reports of the effect of working in a telework center on their performance are remarkably consistent across multi-and single company sites, locations (business park, strip mall, suburban), and national boundaries (Japan, Canada, United States). Virtually all participants (e.g., 77% in an internal NTT report [Hirose, 1992] and 81% of the telework center users interviewed in this study) reported that working in a telework center had enhanced their individual productivity. Telework center user's managers generally agreed, although to a somewhat lesser extent. It is worth noting that these kind of productivity levels are not entirely surprising, given the careful selection procedures used to determine who was allowed to work in a telework center. In addition to the nature of the job lending itself to independent work and the individual having shown him or herself to be self-motivated and able to work independently, a third characteristic of selection procedures at most companies was that the worker be highly productive. Nonetheless, these productive workers reported that their productivity increased even further as a result of their working in a telework center.

The user explanations for increased productivity were also consistent across sites, countries, and job functions. Telework center users attributed increased productivity to a much greater ability to concentrate because of fewer distractions and interruptions. These ranged from telephone calls and supervisors and coworkers dropping in to chat and ask questions to the general visual and audio distractions found in most workplaces. The low occupancy level in all the telework centers we observed, combined with the fact that telework center users often were from different companies (in a multi-company site) or from different departments (within a single company site) and therefore tended to have little or no interaction with each other, created what was, in fact, an extremely quiet and calm workplace.

Enhanced productivity was also attributed to significantly reduced travel times (see "Effects on Transportation and Environmental Quality") and the associated reduction in travel-related stress. In a few cases telework center workers also mentioned working longer hours because of the ease of dropping back into an office located near where they lived in the evening or on the weekend, or not having to depend on public transportation.

Interestingly, several of the telework center users' coworkers in the central office mentioned increased workloads for themselves and others as an unanticipated negative effect of some members of a group telecommuting. Additional workload ranged from answering telephone calls to time spent brainstorming with the manager or handling other kinds of inquiries that would normally be handled by the telework center user. None of these added responsibilities were described as major blocks to working effectively, at least in the short run, but ways of addressing them need to be considered in the ongoing evolution of remote work. If work is consistently redistributed as a result of employees working remotely, the productivity of workers in the central office will likely be negatively affected. These decreases in central office productivity could potentially nullify any increases in individual productivity associated with working remotely.

One of the few complaints of telework center users in terms of their ability to perform work at the telework centers concerned the general lack of technical support. Most of the telework center staff played a coordinating role and were not competent to assist users with equipment malfunctions or answer even routine technical questions. If any problems/malfunctions were to occur, users were virtually on their own to find a solution.

Communication

In terms of communication between telework center users and the central office, there were downsides to working in telework centers, particularly for telework center coworkers and managers. At several sites managers mentioned difficulty in maintaining the kind of informal communication they were accustomed to in the central office. This included the ability to brainstorm ideas quickly and easily. Small changes in operating and work procedures decided by a work group or even a larger and more formal organizational unit were not always communicated to telework center users effectively, or in some cases, not at all. The lack of/inefficient communication was a result of simple oversight in some of the instances, or simply because the communication occurred much more slowly compared to when everyone was together in the same office. One outcome of this was telework center users producing work that had to be redone so that it conformed to new work procedures about which they had not been informed.

Another type of informal communication that seemed to suffer was the informal mentoring and training that often occurs between managers and staff and among the staff themselves. This kind of informal on-the-job training and development is widespread and of critical importance to the success and continued welfare of the organization. It is, in fact, where staff learn a good deal about how to actually do their job. Over time, the reduction in such "training" activities is likely to have a significant effect on the organization as a whole.

One cultural difference between the Japanese telework center users and the North American users was that the Japanese telework center workers reported more feelings of social isolation and insufficient communication with their supervisor and coworkers. The North American telework center workers generally liked being away from the social bustle of the central office and felt they had sufficient communication with their supervisors via telephone and/or e-mail contacts throughout the day.

One explanation for this difference is rooted in differences between the work cultures. In Japanese organizations job descriptions and responsibilities are rarely explicit and clearly defined. The considerable ambiguity in what is to be done and how it should best be done is resolved in hundreds of daily spontaneous face-to-face communications among work groups. The typical open Japanese office in which supervisors and staff alike sit at desks often arranged facing each other in islands, without panels of any height separating the desks, maximizes the potential for informal communication that can clarify ambiguous tasks and responsibilities. The telework center, where one works remotely from one's work group, makes such short, continual contact extremely difficult—if not impossible—even with the aid of sophisticated information technology like videophones and real time video links between the central office and telework center.

The importance in the Japanese culture of having coffee or breakfast with friends, colleagues and managers before work, and drinks and dinner after work, was also significantly eroded for telework center workers, thus contributing to their sense of social isolation. For many North American workers, their social life focuses as much, if not more, on friends and family outside of work as it does on social interaction at work. Management practice tends to explicitly define jobs and responsibilities, and a great deal of importance is attached to the ability to be self-managed and to work independently, with the emphasis on individual performance rather than group. Given these difficulties, telework centers were not surprisingly viewed by North American workers as enhancing their performance and a welcome relief from unwanted social contacts at the office, but as socially isolating for the Japanese worker.

Social and Organizational "Connectivity"

Other drawbacks identified in the post-occupancy surveys and interviews were more subtle. While some coworkers liked the telework center model because the reduction of the number of people in the central office afforded them more space, privacy and access to equipment, some voiced concern about being "left behind." Specifically, coworkers remaining in the central office in some cases felt envious of their telework center counterparts or did not appreciate taking the brunt of what they perceived to be an increase in work requests due to smaller central office staff size.

Telework center users voiced their own forms of separation anxiety. Some telework center users—particularly those in Japan—expressed worries about the potential impacts on their careers. They wondered whether working in a remote location made them less visible to their supervisors and, thus, less likely to be evaluated positively or promoted than their counterparts at the central office. At the other end of the spectrum were telework center workers from BC Tel, in Vancouver, Canada. Several of those interviewed described being more in touch with the company as a whole. The reason given was the opportunity to meet and talk with other organizational members from a wide range of departments who were also using the telework center. This is a potential value of a single-company telework center in comparison to multi-company sites.

U.S. and Canadian telework center participants spoke of the need for more and better training in alternative management techniques and work styles. Managers wanted more guidance on issues such as performance evaluation, maintenance of group synergy and improving general communication. Workers echoed the desire for better communication links with both their supervisors and central office colleagues. A few also worried that they may be working too much due to the 24 hour availability of most telework center facilities.

The findings from our own observations and interviews are consistent with the findings from a variety of other internal and often unpublished research reports (Finlay and Rouse, 1992; Hirose, 1992; Quaid and Lagerberg, 1992; Rao, 1993).

Summary of Findings

Performance and Communication

In summary, our data indicated that those employees using telework center facilities were very positive about their experiences with them, and that telework centers ultimately enhanced their productivity. Their managers generally concurred. Findings from other telework center evaluations are consistent with our findings. For example, in a survey of 25 users of the telework center office in Hawaii (*Final Evaluation Report...*, 1991), nineteen users and twelve supervisors felt that productivity was greater than before they began utilizing the telework center. The two major reasons cited by the managers for increased productivity were fewer disruptions at the telework center and a reduction in travel-related stress, both of which agree our own findings. In a study of the Puget Sound telecommuting program sponsored by the Washington State Employment Office (Quaid and Lagerberg, 1992), almost 30% of the telecommuters felt that their productivity had improved; 8% felt it declined. However, one third of the supervisors reported decreases in the telecommuters productivity, a higher figure than occurred in our case study sites and at other sites.

The improvement in self-reported productivity by employees, with their supervisors agreeing but to a lesser extent, appears to be consistent across culture, the nature of tenancy (single vs. multi-company), type of work, and telework center location (greenfield business park vs. strip development vs. suburban location vs. residential neighborhood). There were differences, however, among other issues related to the telework centers as a function of culture and the nature of tenancy. These issues centered around users' connectivity with the organizations: social isolation, self management, and communication with the central office.

There was a greater sense of social isolation and difficulty in self-management among the Japanese workers than those in North America. And while workers in both multi- and single-company sites reported generally high levels of satisfaction and enhanced individual productivity, observations and interviews suggested that in the North American single-company site which had a high social density (that is, more than 50% of the available workstations were occupied on any given day) there was a greater sense of being connected to the company as a whole, and less concern about being out of touch with the central office. These findings did not seem to vary much as a function of the job itself, which is not surprising since part of the selection process was designed to insure that jobs being done in telework centers did not require constant and close supervision or teamwork.

Effects on Transportation and Environmental Quality

This study's primary emphasis was on the organizational implications of new work patterns involving the use of telework centers and neighborhood work centers; not on traffic demand issues. However, the use patterns of telework centers do effect transportation-related concerns.

As Table 4 shows, North American telework center workers reported a highly significant decrease in mean travel times between their typical daily commute to a central office in comparison to the telework center. On average, there was an 86% savings in commute time, or about 76 minutes per day each way. Using the average time from the Tokyo central train station to the various telework centers as an estimate of time savings between traveling to a central office and traveling to one located within 30 minutes of one's residence, suggests that the Japanese telework center user saves about 25 minutes per day each way.

Research findings from other studies concur with our findings. At BC Tel's telework center, the users each saved 1.75 hours per day and $3.45 CA by not commuting into Vancouver (Finlay and Rouse, 1992). In Hawaii, the users saved 1.1 hours per day and $3.66 by using the telework center (*Final Evaluation Report...*, 1992). Near Los Angeles, the savings were equally significant, with the users of the IEEP's Riverside Office saving 1.6 hours per day (*Final Report...*, 1992). The IEEP users also estimated that they spent a total of $14.50 per day on gasoline, insurance, maintenance, and other transportation costs.

While use of telework centers represented a substantial savings to the employees in the form of time saved commuting, the effects of telework centers on the overall environment are not as positive. A review of the research literature on telework centers (*Final Evaluation Report...*, 1991; Finlay and Rouse, 1992; Quaid and Lagerberg, 1992; *Evaluation Report...*, 1992) shows that telework centers' contribution to improving air quality has been less than expected.

In California, where automobile traffic is measured in cold starts (the number of times a car is started with a cold engine), not miles driven, the telework centers have not helped the environmental problem. At the IEEP's Riverside Telecommuting Workcenter, for instance, 97% of users drove to the office alone. If these employees had participated in car pools to the central office, commuting to telework centers could actually increase the number of cold starts.

During the one year pilot of the Hawaii Satellite Office with 17 stations and 25 users, the situation also was not entirely positive from an environmental standpoint (*Final Evaluation Report...*, 1991). They found that three types of situations counteracted travel savings.

- Stop-off attendance, where a participant uses the telework center to conduct some of her business and avoids traveling during peak traffic times (such as a person who makes appointments from the telework center in the morning, then drives into town to visit with clients, then finishes their day at the telework center and enjoys an easy drive home).

- Non-drivers: users who formerly used buses or car pools to get to work who drive to the telework center.

- Backtracking: users who drive into town for some reason (including taking children to school and continuing participation in a car pool) and then drive back to the telework center.

Discussion of Telework Centers

The following sections discuss some of the IWSP and other research findings on telework centers and their implications on issues such as:

- Productivity and Communication.
- Supervision and Management.
- Cost, Space, and Design.
- Technology.
- Transportation and Environmental Quality.
- Community.
- Family.

Impact on Productivity and Communication

In assessing the effects of telework center on performance and communication, one needs to be clear about whose perspective is being considered. From the perspective of the individual telework center user, self-reports consistently show that productivity is greatly enhanced. One can argue that this increase in productivity stems from the fact that telework center users are in most cases selected based on their high level of performance in the central office; users are highly productive before they use the telework centers, therefore their productivity will generally appear higher than those who do not use the telework centers. There is evidence, however, that productivity increases across all users, both those workers that were *already* highly productive, and those that were marginally so before using the telework center. The US Federal Government's Flexiplace telecommuting project ("Washington Report...", April 1993), the only telework project to date that was open to all interested users rather than screening for the most productive users, indicated that productivity improved across all users that telecommuted, even those whose performance prior to telecommuting was average.

Our data suggests, however, that while individual productivity increases for telework center users, productivity may suffer somewhat for colleagues and coworkers who remain in the central office. These workers now perform more activities that before telecommuting were more evenly shared, things like answering telephone calls, mentoring, informal training and brainstorming. In addition, work practices such as informal work-related interaction and team support (i.e., team efficiency) may be more difficult to maintain as a result of key employees working remotely. The fact that in these early examples of telework centers the best people were often selected/allowed to work in them, and that these people were often the ones sought out as mentors, bares closer examination in future studies. If mentoring truly does diminish, particularly that form that is closer to on-the-job-training than general guidance, then over time organizations may be undermining their own long term effectiveness.

Considering the effects of telework centers not just on the telework center users themselves, which tends to be a primary focus in news articles and many reports and videos evaluating early pilot studies obscures the fact that the workplace is a system in which changes in any part have repercussions for other parts of the system. This is as true for how productivity is assessed as for any other aspect of the system. From the organization's viewpoint, telework centers (or any other workplace strategy) should enhance the overall performance of the system, or organization, not just individual performance. This is likely to require a much more subtle understanding of how work is actually accomplished. As Brown and Duguid (1991) have noted, we need to understand what they call "communities of practice" to a much greater extent. That means paying more attention to the "non-canonical" or informal way in which work is actually done and how people learn how to do it. This often bears scant resemblance to how it is described in position descriptions or even taught in formal organizational training programs.

Impact on Supervision and Management

As we have noted in other discussions of workplace strategy (Becker et. al., 1992; Becker et. al., 1993a; Becker et. al., 1993b) and as many researchers and commentators about telecommuting have noted (Gordon, 1991; Nilles, 1992), for telework centers, neighborhood work centers, or any other type of remote working to be successful requires new management attitudes and skills. Traditional supervisory patterns based on the ability of supervisors to visually see their staff working (same time and place supervisory practices) have little value in the context of telework. Even in the traditional central office, a case can be made that much less direct observation and spontaneous interaction between supervisor and staff occurs than is assumed by those who use this as the model. Managers are often physically and visually separated from their staff, with staff more likely to be in open plan workstations and managers in enclosed offices; or, at lower levels in the hierarchy, with supervisors in workstations with higher panels intended to separate them symbolically and physically (for the privacy assumed to be needed to deal with confidential issues that are part of supervisors responsibilities). As the organizational distance between manager and staff increases, the physical distance typically does as well. The executive row, a special floor often with tighter security than anywhere else in the building, typifies the reinforcement of organizational distance with physical distance. Add to this the fact that managers themselves are often out of the office, as well as their staff for meetings, and it becomes clear that the kind of instantaneous contact with staff—whether for brainstorming or monitoring—that is used to justify opposition to remote work may make less sense than it first appears. Having one big roof for all workers does not mean all the workers are always under the roof at the same time.

Remote work requires clear performance objectives. This means a shift from an emphasis on "good citizenship", making sure staff get to and leave the office on time, to an emphasis on what work is actually accomplished within a specified period of time and at a specified level of quality. For those who argue that this is not possible for knowledge workers, whose work does not lend itself to the precise measurement possible in more routine work or in manufacturing, the model of the university—the ultimate knowledge factory—is instructive.

University faculty routinely measure remote performance. Faculty do not follow students around to watch them produce their term papers, lab reports, and/or research studies. Nor do faculty require their students to sit in offices surrounding the faculty member's own office, so that (during the times when the faculty member is in her own office) the faculty can look over the shoulder of the student to see how the work is going. Most faculty would rather not know where or when their students do their work, or what they are drinking, eating, smoking, or listening to, let alone wearing, when they are working. What they do care about is the quality of the paper or research and whether it meets the scheduled deadline. Their role as faculty is to structure the problems and assignments, to guide students to available resources (e.g., libraries), to be available to help them structure their thinking and to provide feedback on work in progress. This is accomplished not by having the student be physically present all the time, but by scheduling appointments, by holding office hours during which someone can drop in without an appointment, by using the telephone, and increasingly e-mail and voice mail to communicate electronically as well as face-to-face. The ivory tower is, in fact, a good working model of the modern workplace.

What this means for management is:

- Development of skills related to setting clear performance and quality targets.

- Learning how to use information technology like E-mail, voice mail, and fax effectively.

- Learning to structure one's own time more efficiently and effectively, as well as helping or providing resources and guidance to staff to do the same thing.

- Accepting that occasionally having staff work remotely will be inconvenient; but assessing this inconvenience within the frame of the overall effectiveness of the system.

- Taking the time and making the effort to understand how having some staff work remotely affects those not working remotely.

- Creating or inventing new policies and practices that protect the productivity and work loads of those not working remotely.

- Encouraging socializing and meetings between central and remote staff, not viewing this as wasted time or "goofing off."

Having staff work remotely certainly requires *different* management skills and attitudes, as noted. Whether these require more management time or effort is not clear. At least initially, however, remote work will require more attention, more nurturing, and more problem-solving than traditional work patterns that are well-established and routine. These activities are integral to effective managing and supervision in any case. By reducing the opportunity to micro-manage the details of staff jobs, telework centers have the potential to actually free time for true management activities.

Impact on Cost, Space and Design

Key Issues:

- Cost of occupying pilot projects
- Expected cost under market conditions
- Nature of layout and furniture
- Leasing arrangements

The fact that most of the pilot telework center projects to date have been heavily subsidized by the parent organization or by government and private sector partnerships has made it impossible to test the viability of telework centers under normal market conditions; i.e., fair market rents and equipment costs. The fact that several of the multi-company pilot projects have not continued when subsidized funding ended suggests that organizations are not yet convinced of the cost-benefit tradeoff of this form of remote work. Certainly, continuing to provide telework center users with a permanently assigned workstation in the central office only makes sense financially when the telework center is free, or nearly so.

Organizations and public/private sector partnerships implementing pilot studies should consider setting market conditions from the project's inception (as PacBell and the MTA currently are trying to do in northern California). While it may be more difficult to attract organizational support initially (even though this has not been easy even with financial subsidization), establishing market conditions would create pressures for organizations to consider their workplace practices as an integrated system from the beginning. The idea that highly subsidized pilot projects would help entice reluctant organizations to experience a new way of working, which they would then be willing to pay for when the pilot ended, has simply not worked for most of the private sector organizations. To some extent it has worked for government agencies who use their own under-occupied space to support some form of remote work after a pilot has ended. It is unclear why more private sector organizations have not moved in this direction, especially since many firms have a surplus of space.

Here, too, the concept of the workplace as an integrated system of settings is critical. Rather than thinking of having to lease space at an additional cost that few organizations are willing to bear, more attention should be paid to changing the use patterns and behavior in existing space. In the Netherlands, for example, the government realized that workers from two areas were commuting considerable distance to get to office buildings close to where the other workers lived. In effect, each morning workers were driving past government offices near their homes to work at buildings far from them. There is now a small government pilot project in which workers can work for a few days a week in the government building closer to their homes, so that worker A works a few days in worker B's building, and visa versa. This requires allocating some space in each building for these temporary workers, but it does not require additional lease costs.

Most telework center users occasionally return to the central office, often 2-3 times a week. Given the telework center workers concerns about keeping in touch with coworkers and supervisor and with changes in work processes or procedures, as well as just getting to know new people and keeping up friendships and contacts with others, much more attention should be paid to the design and use patterns of telework center workers when they return to the central office. It makes little sense for them to return to the central office, often enduring a commute of from 1-2 hours each way, to do exactly the same work they were doing in a telebusiness or neighborhood work center located a few minutes from their homes.

This suggests that the conventional office design of workstations or enclosed offices needs to change to support more interaction and teamwork. Non-territorial offices in which the telework center worker has no personally assigned permanent office or workstation at the central office, but rather occupies a place that is within the area of permanent offices, makes sense financially, since it is difficult to justify providing a worker with an office that is used only 30-50% of

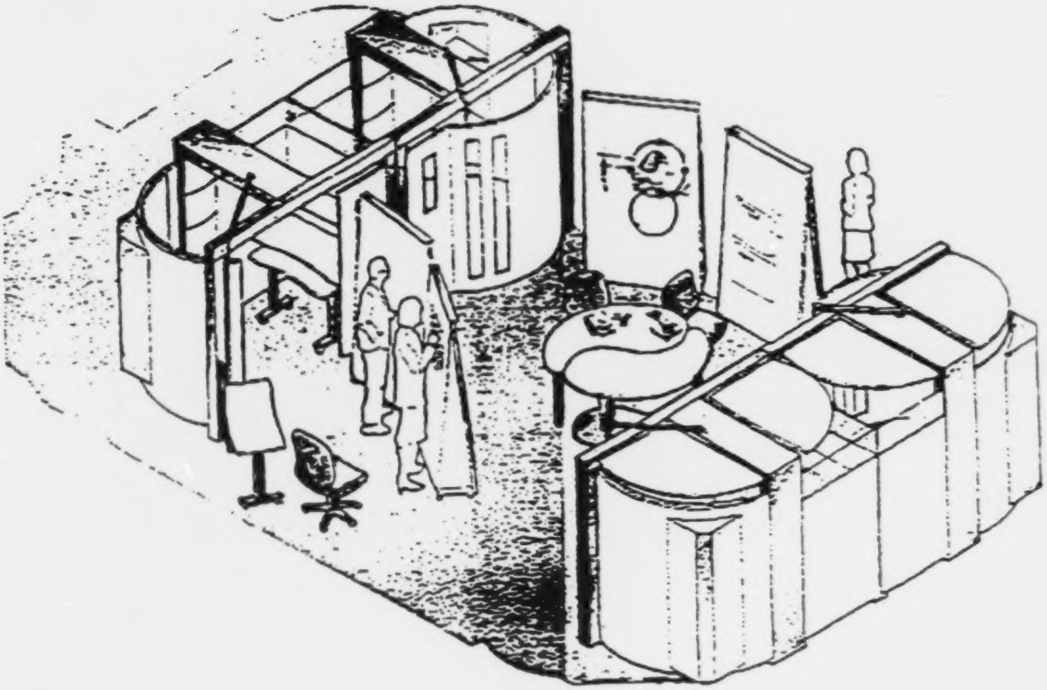

Figure 2: The Personal Harbor and Commons by Steelcase, Inc.

the time. But equally or even more important, non-territorial offices for telework center users allow workers to sit at a different place each day, thus helping to insure that the telework center worker is visible to and touches base with many different people within their central group, not just those whose workstations happen to be closest to their assigned place. More attention to providing some *visible* meeting area within the group space (see Figure 2: The Personal Harbor and Commons by Steelcase, Inc.) that encourages group members to stop by, or just overhear what is being said, would support the need for time in the central office to be used largely for communication, and time in the telework center to be used largely for more concentrative work. Currently, only half the equation—the more concentrative work while at the telework center—tends to occur.

Impact on Technology

Key Issues:

- Required technology
- Maintenance
- Security
- Training
- Cost

The findings from this an other studies of telework centers suggests that technology above and beyond E-mail, voice mail, fax, and computers, all of which are basically standard, by itself does not make a significant difference in user acceptance or performance. In Japan, where the NTT single-company offices had a much higher level of information technology than in the North American sites, there was not significantly greater acceptance or performance. Even with user friendly videoconferencing and the availability of videophones and real-time video connections between central and telework centers, Japanese users still reported a sense of social isolation. This sense of isolation was powerful enough to negatively influence their decision to use the telework center as an alternative work setting. These findings indicate that technology should be viewed as an "enabler" rather than an "inducer;" technology enables the user to move among various settings over time, with information always being accessible via electronic highways, but does not necessarily instigate working remotely.

In no instances did either managers or staff mention concerns about the security of information. In part, this may be because in multi-tenant sites, companies sometimes installed their own computers, thus bypassing the problem of security on machines used by employees of different companies at different points in time.

There were relatively few laptop computers being used, and no docking systems in which a laptop was used as the processing unit by plugging it into a feed from a large monitor which is easier for the user to view. Providing such a system is one way of reducing the need to provide more than one computer for a single person working in several sites.

Several of the problems cited by users or their managers might be resolved with the advent of different technology or the better use of what already exists. For example, the problem of staff in the central office changing work procedures without quickly informing the telework user could be rectified by making it mandatory for all changes to be recorded on a special computer-based form that would automatically signal to users that some change had occurred, not unlike

E-mail systems that signal with a special sound that the user has received mail.

For certain kinds of work, such as that requiring the development and review of graphics, wideband network capacity is essential. Without it, work is literally not possible. And regardless of what technology is provided, users must be trained in its use. This goes beyond technical training in learning how to operate software or equipment. It includes training in knowing how to take advantage of the range of features typically present in today's software. As part of this training users need access to assistance from wherever they are working. This could range from being able to access video training libraries via videophones or videolinks in desktop computers, which is already possible in Japan, to being able to call a customer support person who will troubleshoot problems on-line with the remote user.

Impact on Transportation and Environmental Quality

Key Issues:

- Amount of travel
- Travel patterns
- Effects on air quality

Current use patterns of telework centers in effect limit the benefits that both employees/organizations and transportation/environment receive as a result of using this form of workplace alternative in two ways. First, the relatively rigid scheduling of telework center use, in which each employee works in the telework center on a specific scheduled day eliminates some of the flexibility in work patterns that telework might support. With specific days scheduled, the worker has little opportunity to tailor where and when they work to the kind of work they are doing at the moment or to other circumstances, including personal and family situations that may affect their ability to work effectively. Thus telework centers used in this way contribute little to flexible work patterns. They also do not serve the need of workers whose jobs require them to be in and out of the office in unpredictable time patterns, for example people in sales, consulting, customer service, and project management.

Second, this use pattern does little to reduce the air pollution associated with "cold starts," that is the number of times the car engine is started. Cold starts account for about 60% of the air pollution generated by automobiles. The focus by traffic engineers on reducing cold starts overlooks the fact that significantly fewer miles are traveled, in California for example, from 40 to 180 miles are saved per day per employee for each day worked in a telework center. Moreover, by working close to home employees have more discretion in selecting when they travel to and from work, thereby reducing traffic congestion.

Thus while telework center use patterns do not appear to reduce air pollution associated with cold starts, they would appear to have the potential to significantly reduce fuel consumption and traffic congestion. In the latter case this should ultimately reduce the need for highway construction by spreading demand out over a wider period of the day. To the extent that telework centers are used in a more flexible manner than is typical currently, in which for example an employee might work at home in the morning, then travel to a residential based telework center in mid-morning or early afternoon, and then to a client or customer meeting in the late afternoon, telework centers do have the potential to increase the number of cold starts. One obvious, but not simple solution, is to locate telework centers so close to residences that people can bicycle or walk to them, to develop small fuel efficient shuttle buses that will take people to and from their homes to neighborhood work centers, and to improve public transportation in the form of buses, light rail, subways, etc. With the exception of shuttle buses, these solutions are difficult and expensive to implement.

Untapped Areas: Impact on Community

Neither this study, nor any others, have explored the effects of telework centers, or telework in general, on the community. One positive implication of remote working on the community is the potential for neighborhood work centers or home-based telework, which keep adults in the community throughout the workday, therefore potentially reducing crime and vandalism. More adults in the community means more "eyes on the street," more casual surveillance of streets and homes. Oscar Newman's "defensible space" concept as well as Neighborhood Watch programs suggest this kind of casual surveillance is an important component of neighborhood safety and security.

Telework centers, especially those that become true neighborhood work centers located in the midst of residential development, will challenge current zoning practices and laws that have as their basic working assumption the desire to physically separate and isolate work and residential activity patterns. Employees working in a neighborhood are likely to want to have a coffee break or to eat lunch outside their office, and if there are enough employees in such centers they will create demand for small restaurants and cafes and other service businesses. These commercial activities have often been resisted by neighborhood groups intent on preserving the exclusively residential character of their neighborhoods.

The continued development of telework centers is thus likely to spark a lively debate about the value and intentions of existing zoning practices, and to bring into conflict residents who do not want or have the opportunity to work at home or in a neighborhood work center with those that do. It also is likely to underline the tensions between the desire to improve air quality by reducing the number of cold starts, the desire to maximize worker flexibility (thus encouraging workers to come and go from home to various work locations as they see fit), and the desire to protect the residential character of neighborhoods, which may be threatened by work centers and the associated commercial activity and traffic they generate, including possibly buses or other forms of "mass" transit that may be expensive and/or noisy. For telework centers to satisfy the full gamut of stakeholders, from individual employees, to the organization, and to neighborhood groups, is going to require the development of not just new workplace systems, but a fundamental rethinking of how we connect how we live to how we work.

Untapped Areas: Impact on Family

Our and others' data (see *Telework Center Users*) suggest that telework centers reduce stress related with long and difficult commutes. Anecdotal evidence consistently shows that teleworkers appreciate the opportunity to spend more, and better quality, time with their families. Chilling statistics on high levels of child abuse in places like Palmdale, California, a bedroom community about a two hour commute from downtown Los Angeles, underscores the dark side of parents who rise and leave their homes at the first light of dawn and return in the evening, utterly exhausted.

The intriguing question for telework centers is their potential to break this daily commuting cycle, and with it some of the alienation, anger, and frustration—and simple exhaustion—without bringing work directly into the home. Most studies (Mahmassani et. al.,1991, Sullivan et. al., 1992) of home-based telecommuting suggest that only about 15% of the working population wants to work at home on a regular basis, even if it is only a few days a week. For some people there just is not enough space at home. For others the home has too many distractions, and for others the home is considered a sanctuary, the one place where work does and should not intrude. For all these reasons the telework center or neighborhood work center would seem like a valuable alternative work location, one without the disadvantages of either a long commute or the collapse of the boundaries between work and home-life.

Conclusion

Telework centers work well from the perspective of those using them, and to a large extent from those supervising telework center users. Yet neither the number of companies, nor the use patterns of individuals within them, has been high. Telework centers appear to be a new work location full of only partially fulfilled promise. Why, if telework centers work so well for staff and their managers, has this happened?

The answer lies, we think, in the failure to conceptualize telework centers from their inception as a new form of work organization which has the potential to combine cost savings with more productive and effective workers. To date, telework centers have been primarily viewed as a solution to problems associated with traffic congestion and air pollution, or as a way to demonstrate the value of new telecommunication technologies. Both of these goals are important and legitimate, but in themselves they are unlikely to generate enthusiasm or commitment on the part of senior managers and executives overwhelmed with concern for reducing costs and becoming more competitive. Addressing these concerns reflects a demand driven model of new working practices.

Yet for the most part telework centers have been supply driven; that is, government and private sector partnerships have worked together to create new places for work, and then to tried to attract corporate users to occupy them. Typically the point of corporate entry in marketing these new work places has been the person responsible for managing traffic demand, or complying with government air quality and transportation regulations. Rarely has the point of entry been senior management, and the primary justification the potential of telework centers to help the organization survive, even prosper, in a brutally competitive economic climate. This, in turn, reflects the failure to consider telework centers as a part of a larger integrated workplace system, rather than as a discreet alternative work pattern to solve a specific environmental problem.

Key Issues:

- Issues of leadership of top management
- Partial solutions vs. strategic initiatives
- PR vs. new ways of working
- A system of settings
- Importance of the planning process

In many cases telework center users have retained their assigned workstations in the central office, resulting in increased organizational costs for both space and technology. In no cases have home-based telecommuting, telework centers and central office been developed as a single, integrated workplace strategy. This might mean, for example, eliminating assigned workstations in a central office (since all the employees only very rarely will be in the office at the same time) and replacing them with a small team office that includes a few non-territorial workstations. If this were done, the cost savings from the central office could be invested in providing space in a satellite location. Rather than duplication of computer equipment in multiple locations, the organization might provide mobile laptop computers that can connect to docking stations with larger monitors and keyboards in telework center and central office locations.

The data we and others have collected on telework centers, as incomplete as it is, suggests that for telework centers, neighborhood work centers, and other forms of telework to be accepted by organizations, there are a range of issues that need to be addressed. These include:

- Training of staff and management in how to get the most value out of information technology that exists, whether it is E-mail, voice mail, facsimile, or the telephone.

- Understanding how new work patterns may undermine subtle but tremendously valuable work practices, such as informal mentoring and on-the-job training of staff of each other.

- Inventing new policies and practices that compensate for valuable work patterns and practices that may be lost with the advent of new working practices. These could range from more departmental "retreats" to make sure everyone understands the basic philosophy and values of a department or program to encouraging and helping staff to use E-mail for informal mentoring; or a combination of telephone, the computer and the fax to provide on the spot training for carrying out a particular task or assignment.

- Conceptualizing the telework center or other forms of telework as part of an integrated workplace system so that effects are examined system wide, not at only one point in the system (at the telework center, for example, or only for the individual employee). This means paying more attention to how a change in one part of the system affects changes in other parts; e.g., assessing whether telework center users' absence from the central office is creating unfair work loads for those in the central office, and then working to balance work loads.

- In the same way, costs need to be assessed in relation to the organizational system as a whole, not just to the space costs in a particular department or division. Thus costs for additional equipment should be balanced against space costs, costs for training, the cost of errors, longer than necessary work cycles, etc.

- The goal of improving air quality needs to be viewed as an outcome of adopting a range of new working practices, which in combination change where, how often, how long it takes, and in what manner we get to work. If the only rationale for adopting a new working practice is compliance with a government regulation, few organizations will involve their senior management in the effort required to transform the organization's culture.

- We need to understand what kinds of jobs—or what aspects of different jobs—could be done in telework centers and other locations remote from the central office.

- We need to separate fact from fiction in terms of what goes on in the central office today.

The fact that few organizations have addressed, let alone resolved these issues, helps explain why telework centers have not been as successful as one might expect. In effect, few organizations have the combination of management skills and practices, training programs, and technological sophistication to exploit the potential advantages of telework centers . Thus, even though telework centers reduce traffic and increase individual productivity, the cost to the organization (as they stand today), may be too high. To reap the full benefits, organizations will need to:

- Change management styles and beliefs, especially about the possibility of remote supervision.

- Change central office design to reflect less intense occupancy patterns and to support more interaction among those people in the office on any given day.
- Rethink how workloads are assigned and distributed, and ways to make these dynamic.
- Devote more time and thought to formal training programs, and informal mentoring and colleague-driven on-the-job training.
- Provide new telecommunications technologies and help people learn how to use them to their full potential.
- Generate results-oriented performance assessment programs.

Putting such tools, techniques, and practices in place is neither easy nor inexpensive. It is likely that the cost that is too high for organizations is not the cost of space or equipment, but the cost of fundamental organizational change. Until such organizational change occurs, the marginal benefit of higher productivity of a very small number of employees working more productively at telework centers is likely to be dwarfed by the perceived costs of the organization adopting a new organizational paradigm.

The dilemma for many organizations is that the kinds of changes noted above are ones they must consider if they want to remain competitive in the face of a world that refuses to stand still. The key, in fact, to adopting new working practices is to see such organizational changes as critical for remaining successful, not simply a way to use telework centers (or any other new way of working) more effectively. The supply side approach, in which a specific workplace solution is offered on the market with the hope that demand will follow, is like trying to jump on a merry-go-round that is already spinning from a stand-still position. It is extremely difficult and the likelihood of getting knocked down is very high. You may be more successful if you run around and then try to get on. This is still hard and you may only partially succeed or fail entirely. But if you get on the merry-go-round before it starts moving, your chances for success are much greater, and the ride may even turn out to be fun.

Appendix A:
Detailed Case Studies of Telework Centers

BC Tel's Langley Telework Center

Operating Organization:	**British Columbia Telephone**
Site Location:	**Langley, British Columbia**
Number of Workstations/Offices:	20
Number of Users:	14 full-time users
Date Implemented:	October 1991

Background

BCTel, headquartered in Vancouver, British Columbia, is the telecommunications company for the province of British Columbia, Canada. Vancouver's traffic congestion is small compared to major urban centers like LA and Tokyo, but is substantial and growing rapidly. As a telecommunications company, BCTel has a vested interest in the growth of telework, reflected in the fact that Canadian Telephone companies have recently spun off special departments to form a company dedicated to new business endeavors. The Langley telework center was initiated by a local real estate developer, who approached BCTel with the idea of forming a telework center. The developer provided the space for a ten month trial and BCTel provided all equipment, furniture, moving expenses, and appropriately trained employees.

Goals

- To increase employee productivity and loyalty, and to reduce absenteeism and commuting time
- To enhance the company's reputation for being environmental sensitive and responsible
- To test and demonstrate new telecommunications products and services

Office Descriptions

Physical Environment

The Langley telework center is set in a strip mall in a suburb of Vancouver 20 miles from downtown Vancouver. The office is 3000 square feet and contains 20 workstations of 60 square feet each. The workstations have approximately 5'6" panels closed on three sides. There are no private offices or conference facilities. The plan provides two equipment/storage areas, bathrooms, and a cafeteria area (sink, refrigerator, coffee, and seating). All of the users of the telework center have given up their full-time desks in the central office.

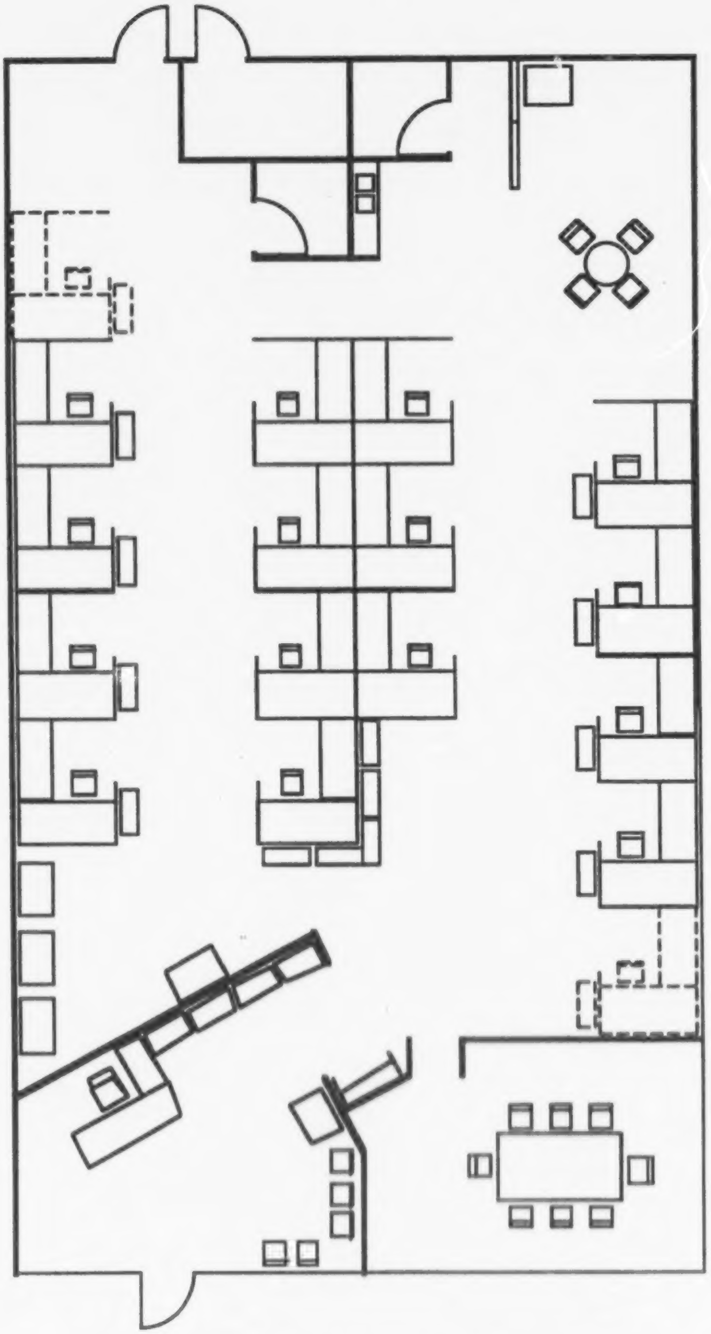

Figure 3: Plan of the Langley Telework center

Technology

One of the requirements for being assigned to the telework center was that the employee did not need any expensive technology . Users have access to PC's, Mainframe terminals, E-mail terminals, copier, and fax. The telephones are Off

Premises extensions (OPX) of the central PBX in the headquarters. It provides voice mail and seamless usage (for example, if you are not at your desk to answer a call, it switches over to a central receptionist in the headquarters building). This system has proved to be very expensive. The cost of OPX's is CA$3,240/year per employee, which is the single largest cost of running the telework center. BCTel is currently considering switching to a less costly alternative.

Administration

There is no administrative person in the telework center. The Langley telework center is self administrating. The users each take three month turns as the administrator of the office. This involves primarily ordering supplies such as fax paper. All other support needs are handled through the central office.

Costs

Because of the added costs of a security system and higher telecommunications cost , the telework center is more expensive to operate compared to BC Tel's other nearby sites, as Table 6 shows.

Table 6: BC Tel's Annual Costs Per Employee (All amounts in Canadian Dollars) (Source: Finlay and Rouse, 1992)

	Langley Telework Center (20 users)	Kathleen St. (leased)	Kingsway (leased)	Canada Way (owned)
Triple Net rent (1992-93) or equivalent	$1,655	$2,100	$1,800	$2,100
Operating costs	$710	$1,700	1,095	$1,350
Security System	$400	N/A	N/A	N/A
Incremental telecommunications costs of telework center	$1,543			
Total net cost (without productivity benefit)	$4,308	$3,800	$2,895	$3,450

Photo 9: Exterior of Langely telework center

Photo 10: Langley interior

Use Patterns/Evaluation

Types of Users

The 14 current users of the telework center cover a wide range of job types, educational levels, salary levels, and union affiliation. The job descriptions of the users include the following: billing clerk, service representative, system analyst, engineering technical support, computer programming, methods analyst, production support, and engineering focused on microwave systems. There are three pairs of users from the same department. This appeared to make a big difference to these users. Having someone else there with whom one could talk, complain, ask for help, and share and test ideas seemed to ease a lot of the isolation/distance problems associated with working remotely.

The union was objecting to placing more union employees in the telework center because the union defines jobs as "specific tasks in specific places," and the telework center was considered a new location. Hence, they wanted jobs in the telework center to be posted as new jobs (a new location) and assigned based on seniority. The union employees were not happy about this situation.

About half of the users, those at higher levels, had 24 hour access by means of a key and a security code that allowed access to the office. The lower level users who had more repetitive day to day work could only enter the building during normal working hours. None of the users who had limited access felt that this was a problem.

Performance

The effect of working in the telework center on performance by the 12 users interviewed ranged from no increases to very large increases. Only two of the users rated their performance the same before and after the move to the telework center. The primary reason cited for performance increases was fewer distractions and interruptions and the opportunity for more time to concentrate. Three users also felt that their reduced travel stress, which reduced the time needed to unwind after the commute, was a deciding factor. Other reasons cited include working in a nicer environment, a more relaxed atmosphere, and fewer incoming telephone calls .

Three users said that they put in more overtime at the telework center. This included coming in on weekends, which never happened when working in the central office, and for a blind computer programmer, putting in much more overtime. In the central office he rarely put in overtime because if he missed one bus, it was an hour wait for the next one. At the telework center he did not need to rely on public transportation, so he was able to stay 30-45 minutes later three times a week

There were also several examples of measurable performance increases. These included two billing clerks who were able to complete 3-4 billing periods/week compared to 2-3 billing periods (the unit of their work)/week in the central office. Another user, a technician who handled technical support calls reported handling 40 support calls in the central office and 50 in the telework center (Finlay and Rouse, 1992). There were no changes to this person's job other than the work environment.

Absenteeism among the telework center users was also reduced. The average absenteeism rate among the users dropped from 2.3% to 1.0% in the five month period before and after the start of the trial. This yields a CA$870/person gain in productive time (based on the average salary of the users) (Finlay and Rouse, 1992).

Overall, BC Tel's survey found that 75% of the users would prefer working in the telework center to receiving a promotion (Finlay and Rouse, 1992).

Communication

Four users of the office participated in weekly group meetings by speakerphone for one hour each week. This system worked acceptably most of the time. Problems included it being difficult to hear what other people were saying, getting left out of some portions of the meeting (including visuals), and one party forgetting to call the other.

This problem of telework center users being overlooked occurred in another department where information on changes of procedure were generally communicated orally. In one instance, two employees not told of a change in procedure did assignments incorrectly that later had to be redone, negating the benefit of their increased productivity.

Within the telework center everybody knew each and socialization was about the same as occurred in the central office. When users were asked if they felt as informed or in touch with the company as they did when they were working in the central office, the general response was that they were more in touch. Because the users were from different departments, they had a better sense of what was going on in the company on a whole.

Travel Calculations

The change in travel times was substantial. The average travel time to the central office from the users homes was 83.1 minutes compared with an average of 11.5 minutes to the telework center. This amounted to an average savings of over two and a quarter hours per user per day. BC Tel estimated that the direct savings in commuting costs was CA$69 per person (Finlay and Rouse, 1992).

The users of the telework center visited the central office from two times per week to two times in twelve months. The average rate of visiting was one visit every two weeks.

Future

BC Tel has declared the Langley satellite office a success and has decided to look for additional sites to open other telework centers.

Background information for all of the Los Angeles telework centers

Southern California's traffic congestion and air pollution problems are among the worst in the world. In response, legislation known as Regulation 15 was passed. It mandates that companies reduce employee car trips to help improve air quality. Telework centers which enable employees to significantly reduce the length and number of commutes have been developed by government and private sector partnerships to help organizations in Southern California comply with Regulation 15.

The Inland Empire Economic Partnership (IEEP, 1991-1) operates four of the five telework centers east of Loa Angeles. The IEEP is "a non-profit, privately funded organization for the purpose of promoting economic growth and development in the Inland Empire. It... works to improve the quality of life in the region" (IEEP, 1991-1). The fifth telework center is operated by the County of Los Angeles.

The IEEP's telework centers are funded through a variety of sources. The major funding comes from government organizations such as the State of California, the South Coast Air Quality Management District (AQMD), and the San Bernardino Associated Governments. Companies such as Centermark, Contel of California, GTE, Hayworth, IBM, Southern California Edison, and Xerox have also funded the project.

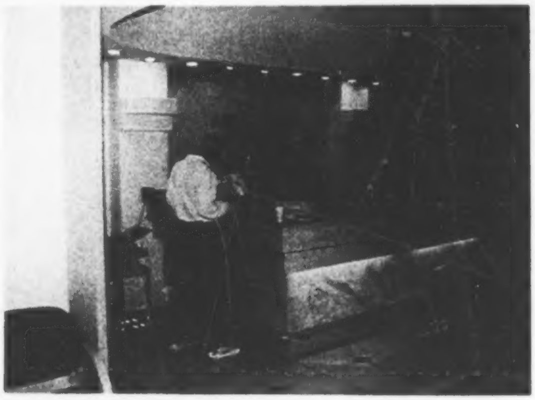

Photo 11: Reception at East Highland Ranch telework center

Photo 12: Conference room at Riverside telework center

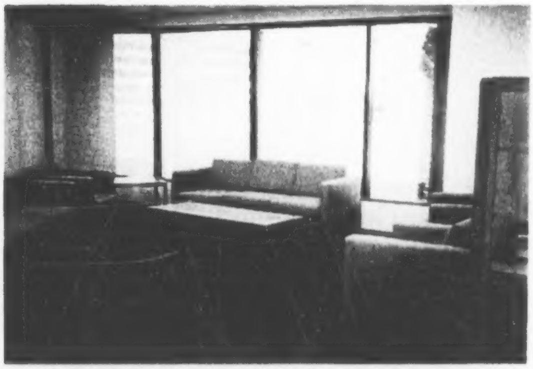

Photo 13: Break area at Ontario telework center

Photo 14: Workstations at Apple Valley telework center

Los Angeles County received seed money from a variety of sources. The primary funders were the Los Angeles County Transportation Commission and the South Coast Air Quality Management District. This money was intended to keep the center open and free for the first year. At that time the center needs to become self supporting and will have to start charging the users. The center received donations of state of the art computer systems from Apple, IBM, and Hewlett-Packard and software from Microsoft.

IEEP's Ontario Telebusiness Workcenter

Operating Company: **Inland Empire Economic Partnership**
Site Location: **Ontario, CA**
Number of Workstations/Offices: 24 workstations
Number of Users: 39 Users
Date Implemented: 1 October 1991

Background

The Ontario Telebusiness Workcenter occupies part of one floor in a recently developed business park located two minutes off of a major East-West Freeway leading into Los Angeles.

Goals

- Reduce the length and number of commuting trips, and the number of "cold starts."
- By minimizing space and equipment costs encourage organizations to experiment with and become comfortable with telecommuting.

Office Descriptions

Physical Environment

The 4,300 square feet telework center contains 24 open plan workstations located in two areas. One area has four workstations and the other has twenty. The office also contains two conference room (for 5 and 12 people), a reception area, a kitchen, a copier/fax room, and an informal seating area for 9 people. The workstation area is very generous and the workstations themselves large (approx. 6' x 8').

Technology

The telework center provides a general use copier and fax machine, telephones, and voice mail. Each workstation is provided with a PC, dot-matrix printer, and modem.

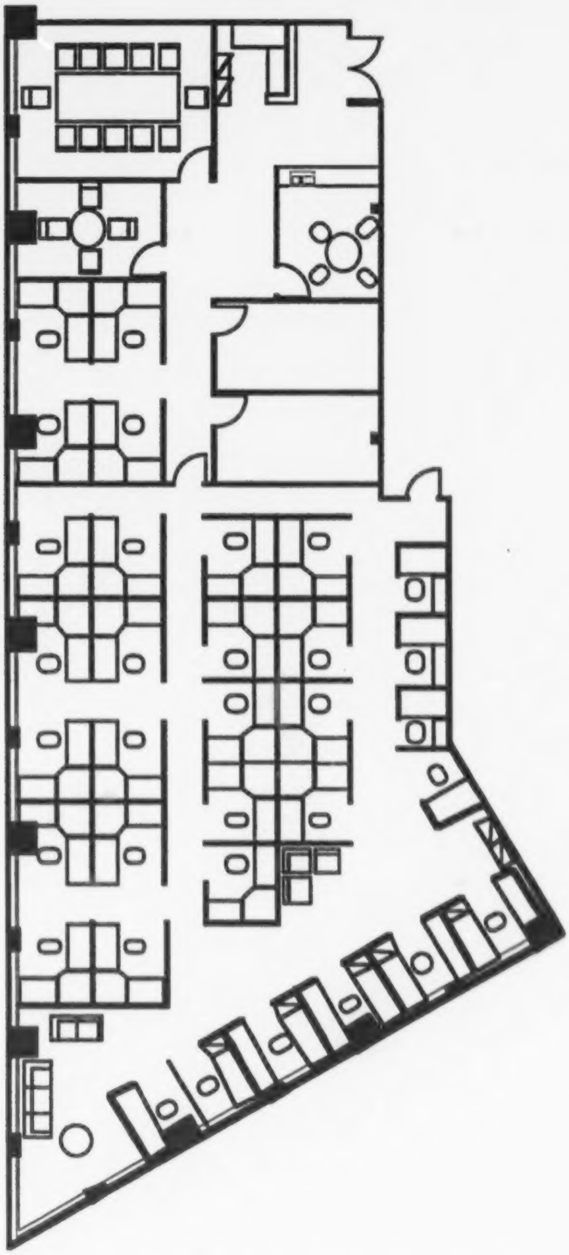

Figure 4: Plan of Ontario Telebusiness Workcenter

Administration

The office administrator provides no secretarial services or telephone answering for the office. Her responsibilities include reconciling telephone bills, monitoring usage, providing tours for visitors, and ordering supplies.

Costs

The IEEP charges $100 per month for rental of a workstation including the equipment. Telephone lines are $17.92 per month and voice mail is $10.95 per month. In addition, companies pay for their individual calls and faxes.

Use Patterns

Usage

The telework center has 15 workstations rented (out of 24 total) to five different companies. These companies have 39 users scheduled to use the office between one day per week and full-time. Not every rented workstation is used to its capacity; some only have users scheduled for part of the week. From February 1992 to December 1992 the average number of users per day was 3.77. The utilization of the rented workstations is 25.1% and for the entire office utilization is 15.7%.

All users have 24 hour access to the office. Most the users arrive very early in the morning, following their usual morning pattern of waking up early to avoid some of the morning traffic. Arrival times range from 5:30 to 8:00 A.M. with the majority between 6 A.M. and 7 A.M.

Types of Users

Five companies rent workstations. These include two utilities company, a telecommunications company, a real estate company, and a military group. Job functions of interviewed users include: systems analyst, commuter programs coordinator, engineering, media relations coordinator, fuel analyst, and auditor.

With the exception of one user who was permanently assigned to the telework center, none of the users had experienced any changes in the central office to account for their being out of the central office one or more days per week.

Conference Room Usage

The large conference room at the telework center was heavily used. Between February 1992 and December 1992 an average of 21.3 meetings per month, with an average of 6.9 people per meeting, had occurred. The majority of these meetings were held in the large conference room. These rooms were available to anyone without fee. One of the most frequent users was, in fact, a company that did not rent workstations.

Performance

Six of the seven users interviewed felt that using the telework center improved their performance. This improvement was attributed to fewer distractions and interruptions than in the central office. Many of the users saved specific kinds of work during the week to do at the telework center. These tasks included reading, correspondence, and highly concentrative tasks like reviewing legal contracts or doing document preparation.

Users reported that little socialization occurred among the center users. Some preferred this because they could take breaks when they wanted, but others missed the social scene of the central office. Several users commented that too much socializing occurred in the central office and the telework center, with less socialization, provided a welcome balance.

Three supervisors of the users were interviewed, all of which had neutral reactions to the telework center. Only one of the supervisors felt that the employee's performance was improved, and this opinion was based on increased happiness of the user and their increased incentive to work.

The supervisors were concerned about the impact of the telework center on their departments. One problem was departments were occasionally short-handed, which led one manager to limit telework to one day per week per employee (in this department with a staff of five, each employee teleworked a different day of the week). Users usually pre-planned their days, and occasionally this differed from what the supervisor was expecting. The remoteness of the location made it difficult for the user or supervisor to change plans. Occasionally a teleworker needed files located in the central office, requiring someone there to search through their files or their computer's hard drive. All of these problems created minor inconveniences for supervisors or telework center users coworkers.

Two coworkers of the Ontario telework center users were interviewed. One reported no effect of having a colleague telework on their own job. The second co-worker functioned as support staff in a department where all five colleagues telecommute on a different day. When this person was at the telework center, the support person received between 1-5 calls for assistance per day. This typically involved faxing or mailing materials, or reading information over the telephone. Some of this work would not have occurred if no one was using the telework center. However, the support staff considered this part of her job and not an imposition.

Communication

Although it would seem that users would rely more heavily on the telephone while teleworking, this was not the case. One user, for example, indicated that he received 25 calls per day in the central office, but only 2 calls per day in the telework center. None of the interviewed users had automatic call forwarding.

Twenty five of the users were from one company, and this company required users to call an 800 number in order to place calls. This added an additional minute per outgoing call, creating a disincentive for placing calls.

Electronic mail usage at the telework center was reduced for most users. This was attributed to the cumbersome procedure for logging on to the mainframes . Fax usage in the telework center was also lower than in the central office, a byproduct of the overall decrease in communication.

All of the managers interviewed felt comfortable calling their employees at the telework center, and tended to speak to them at least once during day. Neither of the coworkers in the central office needed to speak to the users on their days telecommuting.

Travel Calculations

The average travel time to the central office by interviewed users was 75 minutes, compared with 15 minutes to the telework center.

Future

The funding that was originally allocated for the IEEP to set up this telework center ended in October 1993. It is unclear at the time of writing what will happen to the telework centers now that the pilot period has ended.

IEEP's Apple Valley Telebusiness Workcenter

Operating Company:	**Inland Empire Economic Partnership**
Site Location:	**Apple Valley, CA**
Number of Workstations/Offices:	12 workstations
Number of Users:	14 Users
Date Implemented:	1 October 1991

Background

The Apple Valley Telebusiness Workcenter is located in a strip mall 10 minutes off of a major North-South Freeway leading into Los Angeles.

Goals

- Reduce the length and number of commuting trips, and the number of "cold starts."
- By minimizing space and equipment costs encourage organizations to experiment with and become comfortable with telecommuting.

Office Descriptions

Physical Environment

The 2,065 square foot telework center contained 12 open plan workstations (approx. 6' x 8') located in two rooms. One room accommodated the reception area, a conference room for eight, and four workstations. One of these workstations was used as a refreshment center, and another was used as a second workstation for the office administrator. The other room had the other eight workstations and the copier. Because of the small scale and layout of the office, this telework center felt more lively even though the total number of users was fewer than at some of the other centers.

Technology

The telework center provided copier and fax machines, telephones with voice mail, and a PC, printer, and modem for each workstation.

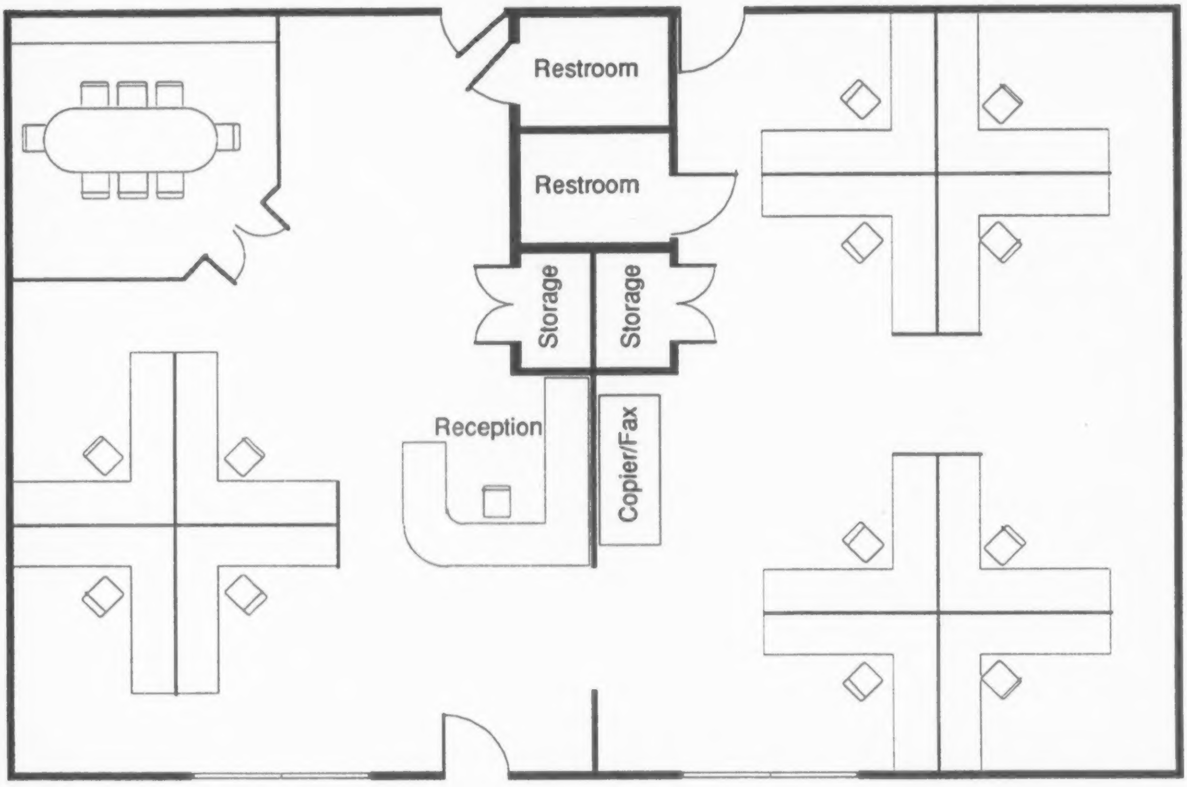

Figure 5: Plan of Apple Valley Telework Center

Administration

The office administrator provided no secretarial services or telephone answering. His functions include reconciling telephone bills, monitoring usage, providing tours for visitors, and ordering supplies.

Costs

The IEEP charges $100 per month for rental of a workstation including the PC, printer, and modem. Telephone lines costs were $53 per month for a Centrex truck which included voice mail, plus an additional $36 for each extra line.

Use Patterns/Evaluation

Usage

Eight of the workstations were rented by five companies for 14 users. These workstations were used between once per week and full-time (one user). Not all of the workstations were scheduled for daily usage. All of the users had 24 hour access to the office. Actual usage of the office between August 1992 and January 1993 was 3.55 users per day. There was a utilization of 44.4% of the rented workstations and a 29% utilization rate overall.

Aside from the full-time user, all users retained their regular central office accommodations.

Types of users

The users job descriptions included: computer programmers, customer analyst, county assessor, health worker, field technicians, sales, nuclear engineering, and a systems manufacturer.

Conference Room Usage

The conference room at the telework center received little usage. From February 1992 to January 1993 there were an average of 3.9 meetings per month (range of 2-7) with an average of 3.3 people per meeting (range of 7-26 people per month). The conference room was available to anyone who wanted to use it without fee, whether or not they were involved with the center in any other way.

Performance

Three users were interviewed at the telework center. Two of them felt that their performance was improved by using the telework center one day per week; the third user did not use the center enough to feel it affected his performance. The reasons sited for increased productivity included fewer distractions and interruptions, less travel related stress, and in one case, a computer system that was available only at the telework center.

The new computer system was used by three field technicians who serviced an area centered 50 miles away from the central office. The computer system was used for initiating routine service calls before problems arose. Before the telework center opened, the technicians had to do this using a very laborious manual system, which they often avoided. The user interviewed estimated that having access to this system increased the all three service representatives productivity 20% by reducing emergency calls.

Communication

Communication did not seem to have changed because of the telework center.

Travel Calculations

Travel times to the telework center ranged from 10-15 minutes with an average of 12 minutes. This was a 48 minute average savings each way per user compared to the usual one hour drive to the central offices of those interviewed (range of 50-70 minutes).

Impact on the Central Office

For all of the users except the full-time user and his associate, neither of whom had other central offices, no changes occurred in their central office. The field technicians almost never visit their central office and operate almost entirely out of the back of their vans, so for them, their days at the telework center were their only times in any office.

Future

The funding that was originally allocated for the IEEP to set up this telework center ends in October 1993. The original intent was to demonstrate that telework centers can be successful and the hope was that at the end of the trial the offices would continue as self supporting endeavors. At this point in time it is not clear whether or in what form this center will continue.

IEEP's East Highland Ranch Telebusiness Workcenter

Operating Company:	**Inland Empire Economic Partnership**
Site Location:	**East Highland Ranch, CA**
Number of Workstations/Offices:	6 workstations
Number of Users:	4 Users
Date Implemented:	31 October 1992

Background

The East Highland Ranch Telebusiness Workcenter is located in the former sales office in a residential development 15 minutes off of a major East-West Freeway leading into Los Angeles.

Goals

- Reduce the length and number of commuting trips, and the number of "cold starts."
- By minimizing space and equipment costs encourage organizations to experiment with and become comfortable with telecommuting.

Office Descriptions

Physical Environment

The 1,700 square foot telework center contained six open plan workstations (approx. 5' x 6') located in the main area, but up to 12 could be accommodated if demand increased. Space for a conference room existed, but lacked furniture other than a TV with VCR. As the space was originally intended as a real estate sales office, it had dramatic lighting, a formal reception area , and cathedral ceilings.

Technology

The telework center had one computer for the administrator and a thermal fax machine which was occasionally used as a copier. The center did not provide computers at the workstations.

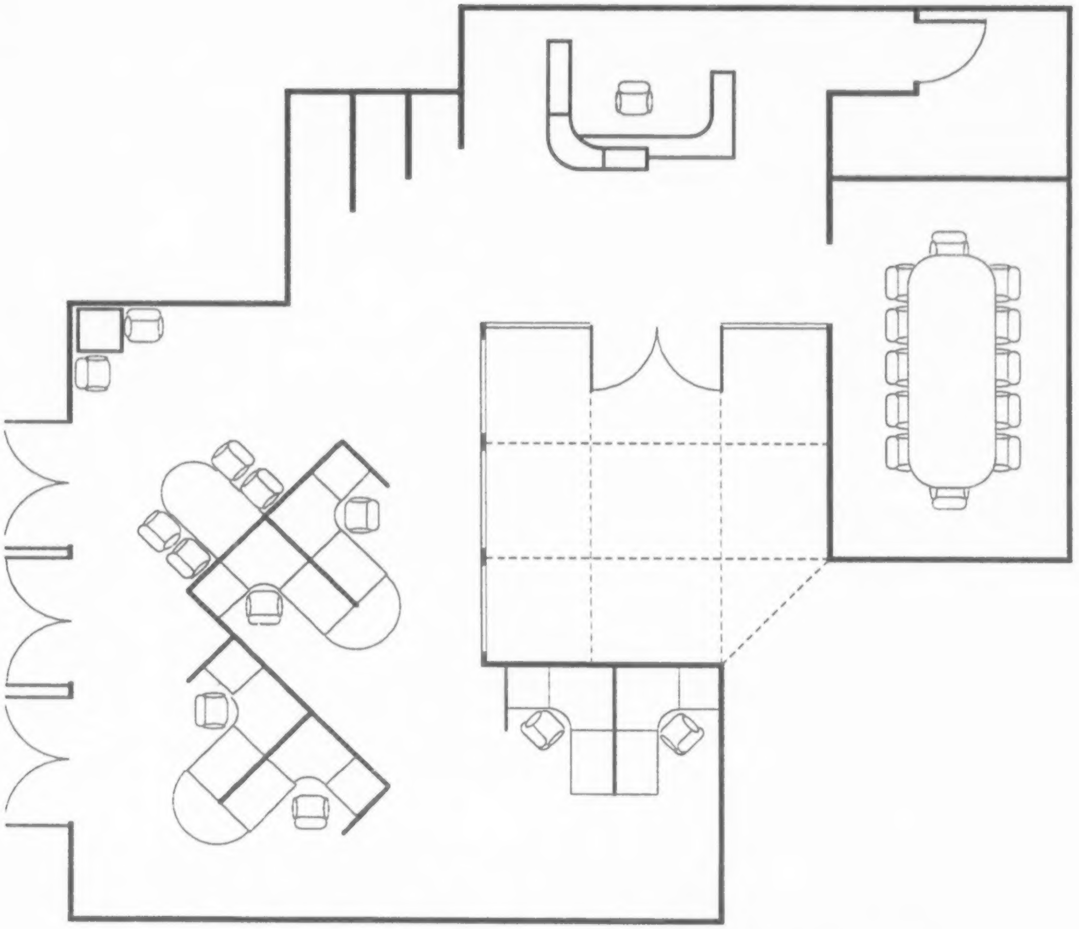

Figure 6: Plan of East Highland Ranch Telebusiness Workcenter

Two telephones were on loan to the office by a telecommunications company. These were interesting cellular/cordless hybrids that relayed a signal to a transmitter in the equipment closet. The phones were passed from one person to another as they were needed. In March of 1993 these were to be replaced by more traditional desk phones.

Administration

The office administrator provided no secretarial services but currently does answer the telephone and take messages because the telephones were not assigned and there were only four users. This will probably change when the traditional phones are installed.

Costs

The IEEP charged $100 per month for rental of a workstation that will eventually include a PC, printer, and modem. Users were charged for telephone calls and faxes.

Use Patterns/Evaluation

Usage

Four users rented space in the telework center. They did not, however, rent specific workstations. Workstations were used on a non-territorial basis (there were no computers or phones to tie people to specific desks). Nothing was stored in particular workstations. All of the users had 24 hour access. As the office had only been open for one month, usage patterns could not be established.

Types of Users

The users came from four different companies and seemed to use the office more as an executive suite than as a telework center. One user was a real estate agent who used the office to make calls and appointments before going out to show houses. A second user was a partner in a small company that sells telemarketing lists. The third user was a salesman with a central office located 90 minutes away. He used the telework center for paperwork and calls.

Performance

Two users were interviewed and both felt the saved commuting time improved their productivity.

Communication

Communication technology was minimal in this office; however none of the interviewed users cited this as being a problem.

Travel Calculations

One user traveled 110 minutes to the central office and 2 minutes to the telework center and the other user traveled 90 minutes to the central office and 12 minutes to the telework center. Using these numbers gives an average of 100 minutes to the central office and 7 minutes to the telework center.

Looking at a month's worth of archival data for the telework center showed that each of the above two users saved 150 miles each way. One of the other users saved an average of 92 miles per day of use and the other saved an average of 110 miles per day of using the telework center .

Future

The funding that was originally allocated for the IEEP to set up this telework center ends in October 1993. It is not clear whether or in what form it will continue.

IEEP's Riverside Telebusiness Workcenter

Operating Company: **Inland Empire Economic Partnership**
Site Location: **Riverside, CA**
Number of Workstations/Offices: 19 Private offices each housing 2-4 desks and room for 19 workstations (total office capacity is up to 70 users per day)
Number of Users: 44 Users
Date Implemented: November 1991

Background

The Riverside Telebusiness Workcenter was originally launched by the Economic Development Partnership (EDP), a non-profit economic growth organization which merged with the Inland Empire Economic Council (IEEC) in late 1992 to form the IEEP.

The Riverside Telebusiness Workcenter is located in a very large strip mall 10 minutes off of a major East-West Freeway leading into Los Angeles.

Goals

- Reduce the length and number of commuting trips, and the number of "cold starts."
- By minimizing space and equipment costs encourage organizations to experiment with and become comfortable with telecommuting.

Office Descriptions

Physical Environment

The 8,100 square foot telework center contains 20 private offices with an average size of 12' x 14'. These offices had room for between two and four workstations each, with an average number per office of three. There were also a number of spaces originally intended for workstations that were empty because nobody wanted to use them. These areas included one very large open area (approximately 30' x 30'), one small open area, and three partially open offices (enclosed on 3 1/2 sides). These areas had the potential to hold 19 workstations. A reception area, two conference rooms, a copier/fax room, a cafeteria, and an informal seating area completed the office.

The total capacity of the office assuming the optimal number of desks in each office was 70 users per day.

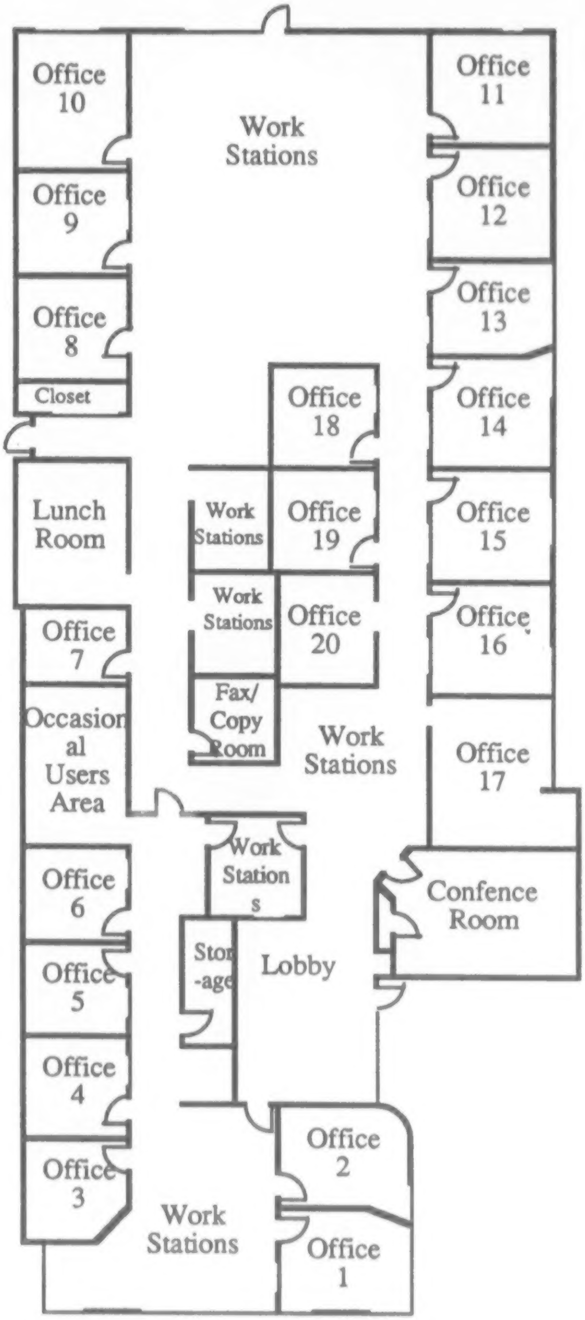
Office 10
Work Stations
Office 11
Office 9
Office 12
Office 8
Office 13
Closet
Office 18
Office 14
Lunch Room
Work Stations
Office 19
Office 15
Work Stations
Office 20
Office 7
Office 16
Fax/ Copy Room
Occasional Users Area
Work Stations
Office 17
Work Station s
Confence Room
Office 6
Stor -age
Lobby
Office 5
Office 4
Office 2
Office 3
Work Stations
Office 1

Figure 7: Plan of Riverside Telebusiness Workcenter

Technology

The telework center only supplied furniture for the offices. Companies installed their own phone/modem/fax lines and equipment. There was a shared copier and fax for the office, but several of the offices had their own dedicated faxes. This seemed to be an excellent idea because the other IEEP offices that provided equipment had difficulties with older machines that could not run the software that the users needed. Here, companies installed and maintained what the employees needed. Also, having the telephone lines billed directly to the companies saved the administrators a tremendous amount of time that in the other IEEP centers was spent reconciling the telephone bills. This meant that companies needed to commit themselves to using the center and make a financial investment in it. There was no way a company could just try out the center or for users to just cut private deals with their supervisors to work there.

The telework center had recently received a grant to install a teleconferencing system in the main conference room (table seating for 12) which should be installed in April 1993.

Administration

The office administrator provided no secretarial services and was solely concerned with the operation of the telework center including monitoring usage, providing tours for visitors, and ordering supplies.

Costs

The IEEP charged $100 per month for rental of an office with the renter's choice of furniture. Workstations were free if anyone requested them, but no companies had. The office administrator felt that this was because of security issues and mentioned that two of the companies only rent offices because they are secured.

Use Patterns/Evaluation

Usage

Nine of the twenty private offices were rented to five companies, and the IEEP uses three additional offices. There were a total of 44 users scheduled, although the offices themselves were not scheduled for continuous usage. The office had a capacity for up to 70 telecommuters per day. All of the users had 24 hour access to the office and they all retained the regular accommodations in their central offices.

In the 42 days period between December 1992 and January 1993 for which we have data, there were a total of 239 users, which averages to 5.7 users per day.

Types of Users

The interviewed users were a manual writer, a customer support representative, a computer programmer, and an accounts executive dealing with the media. Their usage varied from 2-3 days per week to once every two weeks. The 2-3 days per week user varied her schedule to fit her needs. For example, on the day of the interview she was in the office because of flooding in Southern California which would have made her commute longer. She also used the telework center flexibly whenever her work necessitated, rather than only when scheduled. The bi-weekly user (the only user found on such a schedule) had a job that required constant personal contact with the media. This job was not one that could be performed remotely with today's technology.

Performance

Four users were interviewed at the telework center. Two of them felt that using the office had a positive impact on their productivity. Reasons sited for improved performance included fewer interruptions and distractions and less stress and being more alert from not having to drive to the office.

One of the users interviewed reported that using the office had a negative impact on her job. Working with public relations and the media required a level of intensity that she found difficult to maintain working remotely.

Communication

Communication while at the telework center had not changed much for any of those interviewed. Two of the users had their phones automatically transfer to the telework center.

The two interviewed users who had different numbers at the telework center received many fewer calls at the telework center. They posted the numbers for the telework center on voice mail, e-mail, and with their receptionists, but there were still fewer calls.

Travel Calculations

The average travel time to the central office by interviewed users was 87.5 minutes compared to 12.5 minutes to the telework center.

Future

The funding that was originally allocated for the IEEP to set up the Riverside Telebusiness Workcenter ends in October 1993. The original intent was to demonstrate that telework centers can be successful and the hope was that at the end of the trial the offices would continue as self supporting endeavors. It is not clear at this point whether or in what form this center will continue.

LA County's Antelope Valley Telebusiness Center

Operating Company: **County of Los Angeles**
Site Location: **Antelope Valley, CA**
Number of Workstations/Offices: 5 enclosed offices, 15 workstations
Number of Users: 44 users
Date Implemented: 27 January 1993

Background

Antelope Valley is a commuting suburb for Los Angeles. People choose to live in Antelope Valley because of the different lifestyle and cost of living that Antelope Valley offers compared to Los Angeles. With over 38,000 people commuting from Antelope Valley to Los Angeles through a single mountain pass, traffic and air pollution are a tremendous problem. Because of this, Los Angeles county targeted Antelope Valley as a location for a telework center.

The telework center is managed by Los Angeles County and received seed money primarily from the Los Angeles County Transportation Commission and the South Coast Air Quality Management District. This money has kept the center open and free for one year, at the end of which time the center needs to become self supporting by charging the users a market rental rate.

Goals

- Enhance the quality of life for all of the participants
- Participate in local economic development initiatives
- Help business meet SCAQMD (Southern California Air Quality Management District) Regulation XV objectives and reduce traffic congestion and air pollution
- Demonstrate the use of technology in alternative work environments while advocating the use of telework centers

Photo 15: Exterior of Antelope Valley telework center

Photo 16: Interior of Antelope Valley telework center

Usage Goal:

- Los Angeles County guaranteed the funders 50% occupancy by July and 75% occupancy by the end of October

Office Descriptions

Physical Environment

The office is set off a main street in a sparsely developed area located about 15 minutes from Palmdale, the closest major town. The office occupies 2,500 square feet of a building rented by Los Angeles County, which has two other offices in it.

There were five private offices and fifteen high partitioned cubicles available for use plus a kitchen with seating, a conference room with seating for ten, a glass walled office for the on-site administrator, and a copier/fax/printer room. The cubicles were five feet by six feet with five and a half feet high panels and have drawer space and overhead storage. The private offices are eight feet by nine feet and are also equipped with systems furniture workstations.

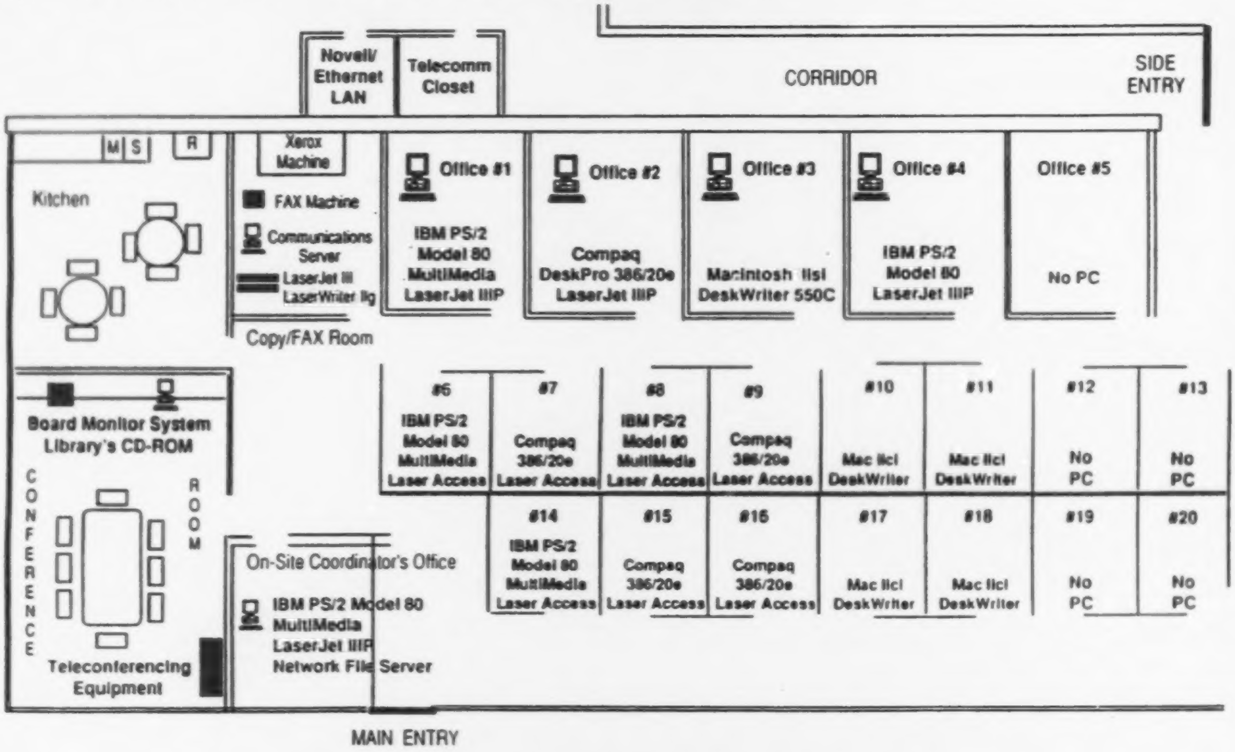
Novell/ Ethernet LAN
Telecomm Closet
CORRIDOR
SIDE ENTRY
M
S
R
Kitchen
Xerox Machine
FAX Machine
Communications Server
LaserJet III
LaserWriter IIg
Copy/FAX Room
Office #1
IBM PS/2 Model 80 MultiMedia LaserJet IIIP
Office #2
Compaq DeskPro 386/20e LaserJet IIIP
Office #3
Macintosh IIsi DeskWriter 550C
Office #4
IBM PS/2 Model 80 LaserJet IIIP
Office #5
No PC
Board Monitor System
Library's CD-ROM
CONFERENCE ROOM
Teleconferencing Equipment
On-Site Coordinator's Office
IBM PS/2 Model 80 MultiMedia LaserJet IIIP Network File Server
#6 IBM PS/2 Model 80 MultiMedia Laser Access
#7 Compaq 386/20e Laser Access
#8 IBM PS/2 Model 80 MultiMedia Laser Access
#9 Compaq 386/20e Laser Access
#10 Mac IIci DeskWriter
#11 Mac IIci DeskWriter
#12 No PC
#13 No PC
#14 IBM PS/2 Model 80 MultiMedia Laser Access
#15 Compaq 386/20e Laser Access
#16 Compaq 386/20e Laser Access
#17 Mac IIci DeskWriter
#18 Mac IIci DeskWriter
#19 No PC
#20 No PC
MAIN ENTRY

Figure 8: Plan of Antelope Valley Telebusiness Center

Technology

The office received computers, printers, software and modems donations from four leading companies. Several models of each computer manufacturer were provided, and participants selected specific workstations with the appropriate computer. One of the participating companies, which rented six workstations full-time supplied its own computers and phone lines.

The telework center also had a $70,000 PacBell video teleconference system which interfaced with similar systems in the LA County Regional Planning Office. It was installed to allow people to attend public hearings of political matters without having to drive into Los Angeles.

The center also has funds intended for some form of desktop video teleconferencing system that will allow voice, video, and collaborative work to occur from the computer desktop. Such systems are currently available from IBM and Northern Telecom, but telephone line incompatibilities prohibited their use. The purchase of this system had been delayed due to the rapidly falling costs, until the first quarter of 1994.

Telephone lines were provided at no charge, and users were expected to use calling cards for all of their long distance needs.

Administration

The workcenter was planning on hiring a full-time administrator, but this was on hold because the county is going through budget cuts and layoffs. Until budget issues are resolved, the center was being run on a part-time basis by the project administrator. The eventual administrator will have a range of functions from ordering supplies, monitoring maintenance work, and acting as a technical support person to marketing the center and training the new users.

Costs

The workstations are currently free, but at the end of the first year they will switch to a fee for use system. This cost will probably be about $20 per day per workstation including phone lines.

Use Patterns/Evaluation

Usage

The Antelope Valley Telebusiness Workcenter differs from all of the shared telework centers that have been examined in that companies do not agree to use an office every day of the week, but rather contract for a workstation by the day. In this system, one company can agree to occupy a particular workstation on Monday and Wednesday, and then other companies can rent it the remaining days. This system helps keep the center occupied because companies only agree to occupy what they need rather than being required to rent a workstation full-time that they only intend to use part of the week. In this system there were a total of 20 places to work multiplied by five days per week, yielding 100 slots.

There were currently 70 slots accounted for and of these 70, only 58% of the users have been trained and had started using the center. The utilization of the space during March through May averaged 60.6%.

Types of Users

The center was used by a total of 28 employees from 13 companies, with the number of employees per company ranging from fifteen to one. These users used the center from once every two weeks to full-time and all users had 24 hour access to the center. Their job descriptions included customer service, worker retraining, telecommuting promoter, marketing, paralegal, administrative assistant, regional sales manager, case reviewer, inspector, and correspondence research. These users included staff and mangers both with and without subordinates.

Half of the users were from one company and the remainder were individual representatives of companies, with two exceptions (one company had two employees and another had three). The company with 14 employees represented a corporate decision to use the center. The individual users from companies were mostly there as a result of private negotiations with their supervisor, which was made easier because there were no costs involved.

Performance

All seven users interviewed felt that their performance had improved. Six users were very enthusiastic about the improvement and one felt that it was only slight. The reasons cited for the performance benefits included dramatically reduced travel related stress, fewer interruptions, and less noise.

Two customer support representatives who used the center reported that they averaged 10 calls more per day when they were using the telework center compared to the central office (average number of calls was 50-60 calls per day). Another user processed 10-15% more cases while at the telework center than she did at the central office.

Two of the managers interviewed reported no changes in the performance of the teleworkers, who were "good before and good after." Unfortunately, the system used for monitoring the teleworkers did not provide the information the same way for remote users (outside of the central office) as it did for internal employees. This made it more difficult for the managers to supervise the teleworkers.

One of the managers interviewed, who was just beginning to use the center herself, found that it was a good place to catch up on paperwork and other business, but that it was impossible to actually "manage" her employees while she was at the telework center since this depended on a telephone system that was not available.

Another of the managers was concerned that one of her staff were spending more time out of the office than was acceptable, reducing the percentage of time that employee spent on the telephone handling calls, which was this company's primary performance measure. When questioned by the manager, the user blamed their performance on technical difficulty, but the manager was still unhappy with the performance and was considering asking the user to return to the office full-time.

Communication

None of the users interviewed, including one full-time user, reported major changes in their communication patterns. The managers interviewed did not notice many changes with the communication except that things normally handled face to face now occurred over the telephone. There was some sense that this took more time than it had when it was done face-to-face.

Travel Calculations

The average travel time to the central office for those interviewed was two hours, with many people using "park and rides" (large parking lots with bus service down to LA) and van pools. The travel times of the users to the telework center ranged from ten to fifteen minutes.

Future

Starting in January of 1994, the office will be switching to a pay for use system. Los Angeles County is trying to secure additional funding to allow a certain number of spaces to remain free so that new companies can try out the office without charge.

Background information for all of the Japanese telework centers

Tokyo has some of the highest population density in the world. Most of the residents rely on an extensive public transportation network to get to work, but the system is currently at or over capacity. The situation has gotten so bad that the train system operators have been running an ad campaign to encourage people to travel at off peak times for over 10 years. Many residents have very long commutes and one plus hours in each direction is very common. Affordable or company provided housing located further from the city center requires even longer commutes.

Overcrowding alone should make Japan a good candidate for using telework centers, however workstyle and cultural values work against, not in favor of, telework. Japanese managers are used to managing a very homogeneous workgroup of Japanese males. Work is usually done as teams with a group of employees and a manager sharing an open space with all desks facing each other during regular set hours. A traditional arrangement is :

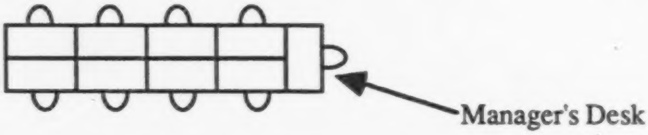

Figure 9: Typical Japanese Desk Arrangement

Work within such groups is very ill defined in terms of who is responsible for what part of a given project. Traditionally, each member of a team works until the project is complete rather than until their portion is completed. Additionally, a recent survey of managers in their 40's showed that 60% of instructions and evaluation is done verbally (Spinks, 1991). These aspects of Japanese working patterns have to change or be accommodated to effectively utilize any flexible working practices, including telework centers.

Home-based telework is mitigated by the fact that Japanese houses are generally small, thus limiting the potential for home-based telework because most Japanese do not have the space in their homes. Also, in the traditional family, fathers typically spend little time at home. The usual work pattern is for workers to work late and then go out drinking with their colleagues. This pattern is an important part of the Japanese workgroup. Because of this situation fathers do not see their children much and their working close to home upsets traditional family as well as work patterns (Spinks, 1991). At the same time, there are few working mothers, and most women when they marry give up their jobs.

Within this context he Japanese telework centers differ from their North American counterparts in a number of ways. The level of amenities that they offer, for example, exceeds most found in North American telework centers. In Japan, the telework centers are typically showcase offices with the latest in high technology and interesting architectural or furniture design. In the United States and Canada, telework centers tend to be functional but unexceptional places, usually with a minimum of sophisticated information technology available. This difference can be explained, in part, by the greater need to

Common information for the NTT telework centers

Background

Nippon Telegraph and Telephone Corporation (NTT) is the telecommunications company for Japan, and as such it also has a large commitment to developing new telecommunications technologies. NTT also owns a large number of buildings around Japan which formerly were filled with telephone switching devices, but which due to the miniaturization and improvement in their electronics can now be placed in a much smaller space. This situation has left NTT with surplus spaces around the country which are not easily reusable as regular office space due to low ceiling heights and few windows. The surplus space in these machine buildings is where NTT has been placing their telework centers. Their three sites were selected based on available space, commuting time and direction from Tokyo (North, West, and East).

Before beginning their own telework centers, NTT joined several telework center projects to gain experience. NTT has provided all of the funding for their telework center and has decided on a three year trial period. One of their primary goals in setting up the telework centers was to act as a realistic testing area for the ISDN technology that NTT is developing.

Goals

- Provide an alternative solution to long commutes and high space costs in Tokyo
- Promote the "Best Office" concept, an NTT plan for a better way of working
- Propose creative workstyles with amenities that will attract workers, including women
- Pilot a project for NTT employees that can provide experience on telework

Office Descriptions

Technology

All of the NTT telework centers are also testing areas for NTT's ISDN (a higher bandwidth telephone system which allows more information to pass over phone lines) and the Funabashi office is a technology showroom. Each workstation is fitted with a networked high quality PC and at Funabashi, a small (approximately 8 inch) LCD color television. This small TV broadcasts news but is also tied into the cameras at the central office that allow the users to see their workgroups, a system called "Tele-eye".

Tele-eye is also available on the video phones and dedicated PC's spread throughout the offices. Tele-eye is a system that uses cameras at the central office to allow the users to see their workgroups. It will display up to six images and update them constantly. An internal NTT report described the Tele-eye as a means to ease the sense of loneliness and alienation from the office while in the telework center.

The Funabashi telework center is equipped with INSnet1500 running at 1.5Mb/s. This allows real time voice and full motion picture transmission. The Ageo and Kamakura offices only have INSnet64 running at 64kb/s, which allows voice and non-full motion picture transmission at a lower resolution.

One of the workstations at the Funabashi office is equipped with two large flat screened multi-purpose color monitors in place of regular CRT computer monitors. These flat monitors are only several inches deep and were built into the wall panel system. The monitors can either display the computer output or video signals.

High bandwidth video phones were also available in the offices. These phones have a built in camera and color LCD display so that they can send and receive voice and video concurrently. The camera was also removable so that it could be pointed at a document and focused in on a specific area (such as a document, a graph, or a computer screen). The phone could also be used to send and receive video-mail, the NTT internal news broadcast, and to access the Tele-eye system. There was also a less sophisticated version of the video phone that had a camera fixed in the base rather than being removable.

Another innovation in the office is a Soft Fax that receives faxes and displays them on a very large (approximate 2 foot by 3 foot) panel. These are displayed until they are no longer needed and save paper (in an environmental aspect). Faxes sent to the Soft Fax can also be transferred over the network to a PC.

Photo 17: Exterior of Funabashi telework center building

Photo 19: Meeting area at Ageo telework center

Photo 18: Reception at Funabashi telework center

Photo 20: Videophone at NTT telework center

One last new device is a Floppy Disk Transfer system that operated over the ISDN network to very quickly transfer complete floppy disks from one location to another. A user inserts their floppy into the machine at one location, enters a phone number and the recipients code, and the machine quickly and accurately sends a exact replicate of the disk to the recipients machine where it is held on a hard drive until the recipient picks it up. This machine has proven very useful to the users and is much faster than sending materials over an e-mail system.

These offices also has the usual assortment of modern equipment including copiers, G4 faxes, printing white boards, dedicated terminals to specific mainframes at the central office (NTT has a special purpose mainframe that can only be accessed through dedicated terminals), and LANs.

The teleconferencing/presentation room at Funabashi had a very large screen video conferencing system composed of 16 adjacent flat screen color LCD panels for excellent clarity. The system, called Face Mate, could also display video's, computer input, and output from an opaque display (a video camera that is set up to display any item placed under it, for example, a brochure). A corner mounted camera and a stereo system completed the room.

At the other two offices, Face Mate existed in a stand alone upright cabinet on casters. The system, which has the same display capabilities as the system described above, had a remotely positionable camera on top and a large color television.

The offices had a sophisticated security and office control system. When a user arrived, they waved their NTT identification cards near a wall mounted panel which unlocked the door and turned on the lights and air conditioning. Leaving the office also required unlocking the door with the key. Once inside, lights were manually controllable. Only users of the telework center had the special magnetic ID cards which allowed them 24 hour access to the office.

Photo 21: Team work area at Ageo telework center

Photo 22: Workstation at Kamakura Telework center

Costs

Average floor space per person in the telework centers was 154 square feet per person, which was approximately double the space per person in the central office. The costs for remodeling totaled ¥350 million or ¥7 million per person. According to Japan's MITI, the average cost for remodeling in Japan is ¥1 million per person. The high cost for the NTT offices corresponds to the spaciousness and the very expensive furniture and finishes in the office. The cost of the telecommunication and other OA equipment for the office totaled ¥150 million (Hirose, 1992).

Administration

There was one full-time staff person, who did not do any secretarial work for the users, at each center. Their responsibilities included reception, tours of the office (and in the case of Funabashi showroom demonstrations of the technology), and managing the center's operations.

Use Patterns/Evaluation

Usage

The specific number of users and usage data for the telework center was unavailable. There were approximately 20 users (40%) for the total of 51 workstations in the three offices. NTT does not want the number of users to exceed the number of workstation. All users had 24 hour access.

On the morning of the visit, only two users plus the receptionist were in the office. All of the users of the office were involved in planning or R&D, but the users were not from only one department. During the visit, the users did not communicate with one another.

The offices functioned as non-territorial offices where the users did not have assigned desks. Rather, they just picked a workstation to use when they arrived. As a result of this, all of the file cabinets were empty and all of the desks were clear almost all of the time.

Types of users

Users were selected from volunteers who lived within a 30 minute commute of the telework centers. They required their bosses approval to participate. Users at all of the NTT sites were assigned to use the office for between 2-6 months and were considered full-time at the telework center, although at the Kamakura Office, where we observed, they only used the office from 2-4 days per week.

The job types of the users included: "1) planning (survey plans and analysis, writing manuals, etc.); 2) sales (including business proposals and presentations, etc.); 3) development (software, technical references, etc.); and 4) company wide duties (in house magazine editing, numerical compilation and analysis, training manuals, etc.)."

In NTT's own internal study, the user's origin of motivation for using the telework center was found to be: 56% self motivated, 33% ordered by supervisor, and 11% other (Hirose, 1992).

Performance and Communication

No users were interviewed as NTT is was reorganizing at the time of the visit and control of the telework centers was divided between 21 departments with none having any real authority.

However, NTT conducted their own internal study (Hirose, 1992) of the telework center users, and found that comparing productivity between the central office and the telework center:

- 77% felt that working at the telework center was more productive
- 10% felt that working at the head office was more productive
- 13% felt that the two offices were the same

This same study examined the perceived advantages of using the telework center and reported that:

- 90% of the users indicated a benefit to be freedom from the long commute
- 75% of the users indicated a benefit to be the larger work areas
- 30% of the users indicated a benefit to be the flexibility to use the office in their spare time

The last issue on the survey dealt with problems of using the telework center. The findings were that:

- 65% felt that the office was not convenient for getting work material or data (that was easily available at the central office)
- 40% felt that the decrease in their relationships with their colleagues during their time off was a problem
- 35% felt less in touch with the company

Addition problems identified with the telework centers were:

- Difficulty with the users self managing themselves
- Insufficient communication with supervisors and coworkers
- The necessity to create a new personnel evaluation system

Impact on the Central Office

As all of the users were only assigned to the telework centers for a short period of time, they all still had their regular desks in the central office.

Future

The NTT Telework centers opened for a three year pilot originally intended to last until April 1994. In July 1993 this end date was extended and no new end date determined, or even if there will be one. While occupancy rates have been low, the centers have been an effective showcase and testing grounds for new telecommunications products.

NTT' s Funabashi Telework Center

Operating Company:	**Nippon Telegraph and Telephone (NTT)**
Site Location:	**Funabashi, Japan**
Number of Workstations/Offices:	14
Number of Users:	Unknown
Date Implemented:	April 1991

Site Specific Background

The Funabashi telework center was located on the 2nd floor of an NTT building in a dense residential and commercial area 20 kilometers from Tokyo. Funabashi is 30 minutes by train from Tokyo Station and another 10 minutes by foot from the station to the office.

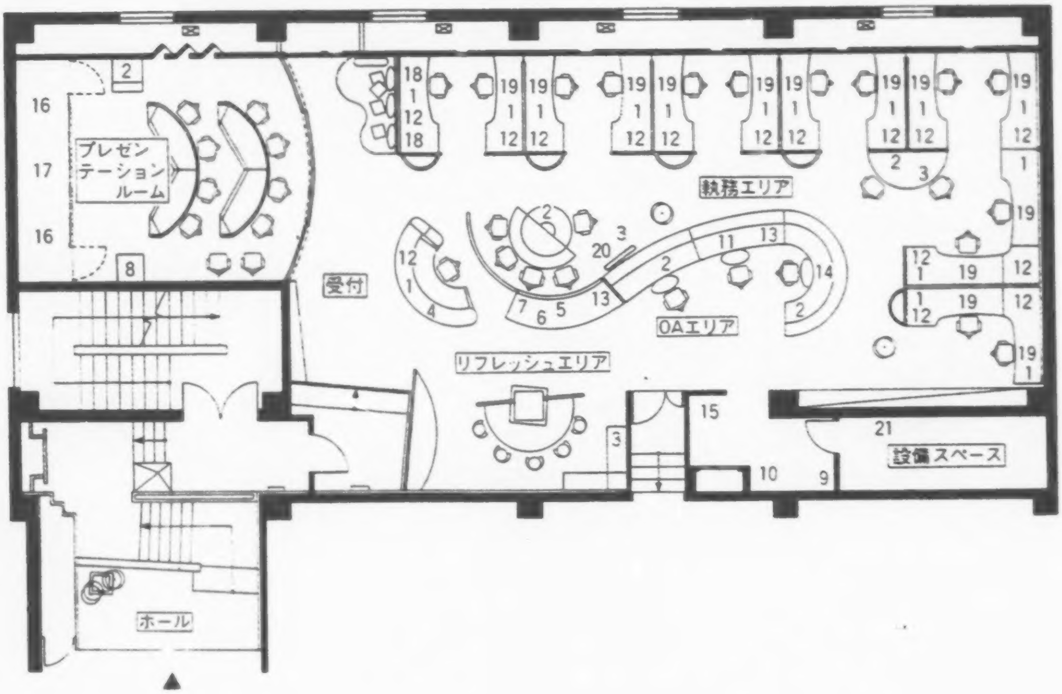
プレゼンテーションルーム
受付
執務エリア
OAエリア
リフレッシュエリア
設備スペース
ホール
16
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Figure 10: Plan of Funabashi Telework Center

Office Descriptions

Physical Environment

The 2,152 square foot (200 square meter) office space had room for 14 users plus the receptionist. It has an eight person teleconferencing/ presentation room (with presentation style seating), a five person meeting area, a specialized equipment area, and a five person break area with food service (the only place in the office where smoking is allowed).

The quality of finishes was very high and contemporary architectural elements abounded. These included a curved wall, dropped ceilings, recessed ceiling cove lighting, and light boxes built into the wall to provide diffuse light (the office had no windows as it was formerly a machine room). The entire office also used a raised panel floor which contained all of the wiring and heating ducts despite the already low ceiling heights (8'-6" or 2.6m).

NTT's Kamakura Telework Center

Operating Company:	**Nippon Telegraph and Telephone (NTT)**
Site Location:	**Kamakura, Japan**
Number of Workstations/Offices:	12
Number of Users:	9[5]
Date Implemented:	6 June 1991 (began operating 19 April 1991)

Site Specific Background

The Kamakura telework center was located in a suburb of Tokyo 50 kilometers from Tokyo. From Tokyo Station it was a 45 minute train ride, a 15 minute monorail ride from the station to near the building, and then a 5 minute walk from the monorail stop to the building, located in a residential neighborhood.

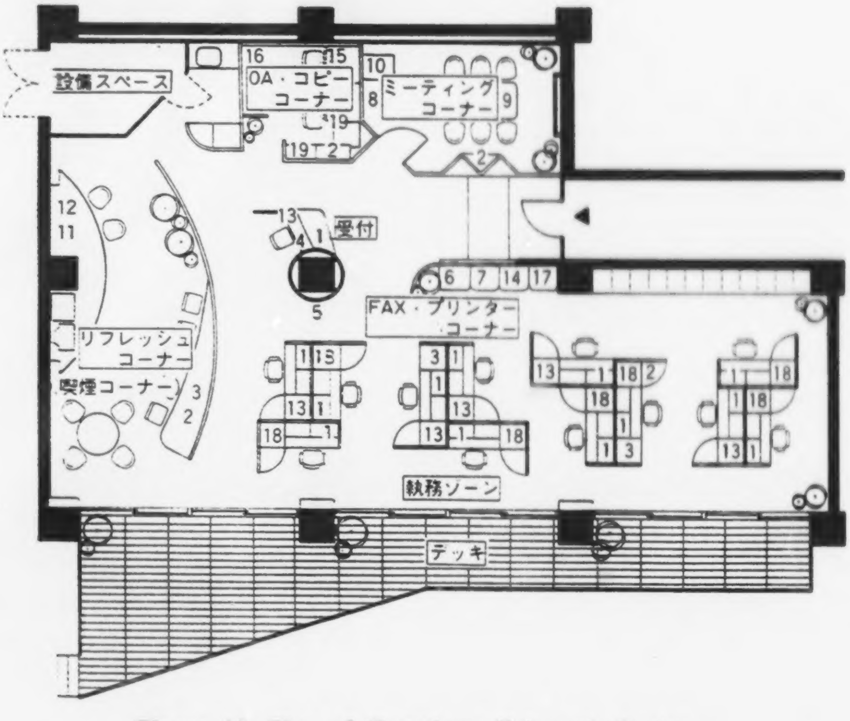

Figure 11: Plan of Kamakura Telework Center

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[5] At the time of the writing of an article in September 1991 there were 9 users including two who were about to return to the central office full time (Takata, 1991).

Office Descriptions

Physical Environment

The 1,722 square foot (160 square meter) office had room for 12 users plus the receptionist. It had a six person teleconferencing room, a kitchenette, a specialized equipment area, and a break area with four counter seats and a table for four. The break area also held communal equipment including a TV, VCR, stereo, terminal, and video phone. One of the long walls of the space was filled with eight sets of doors opening onto a patio for use only by the office occupants.

The quality of finishes was high, with a lot of wood (intended to remind the users of their home settings) and contemporary architectural elements. The entire office was on a raised panel floor which contained all of the wiring and heating ducts.

NTT's Ageo Telework Center

Operating Company:	**Nippon Telegraph and Telephone (NTT)**
Site Location:	**Ageo, Japan**
Number of Workstations/Offices:	25
Number of Users:	not known
Date Implemented:	May 1991

Site Specific Background

The Ageo telework center was located in a suburban area 40 kilometers from Tokyo (about a 45 minute train ride from Tokyo Station). The building itself was a ten minute walk from the Japan Railways (JR) train station.

Office Descriptions

Physical Environment

The 4,089 square foot (380 square meter) office had room for 25 users plus the receptionist. The office had more meeting spaces than it had workstations. These included an eight person teleconferencing room, a four person waiting area, a four person cafe, a six person informal meeting area, a six person meeting area in a corner, and a large eight person meeting area in the central of the office. In addition to the six meeting areas, the office had a specialized equipment area and an equipment room.

The quality of finishes was very high, with many contemporary architectural elements, including angled and curved walls, recessed cove lighting, dramatic column lighting, and a skewed plan which sets the workstations at a 45 degree angle to the room. The entire office was on a raised panel floor which contained all of the wiring and heating ducts.

Two of the workstations areas were intended to promote teamwork by arranging workstations so the users could see each other. These areas, one for three and the other for four users, also had a small conference table in the middle for spontaneous group work.

The central conference area, located in the center of the space at the intersection of two circulation routes, had ceiling-mounted screens that could be lowered to improve visual privacy.

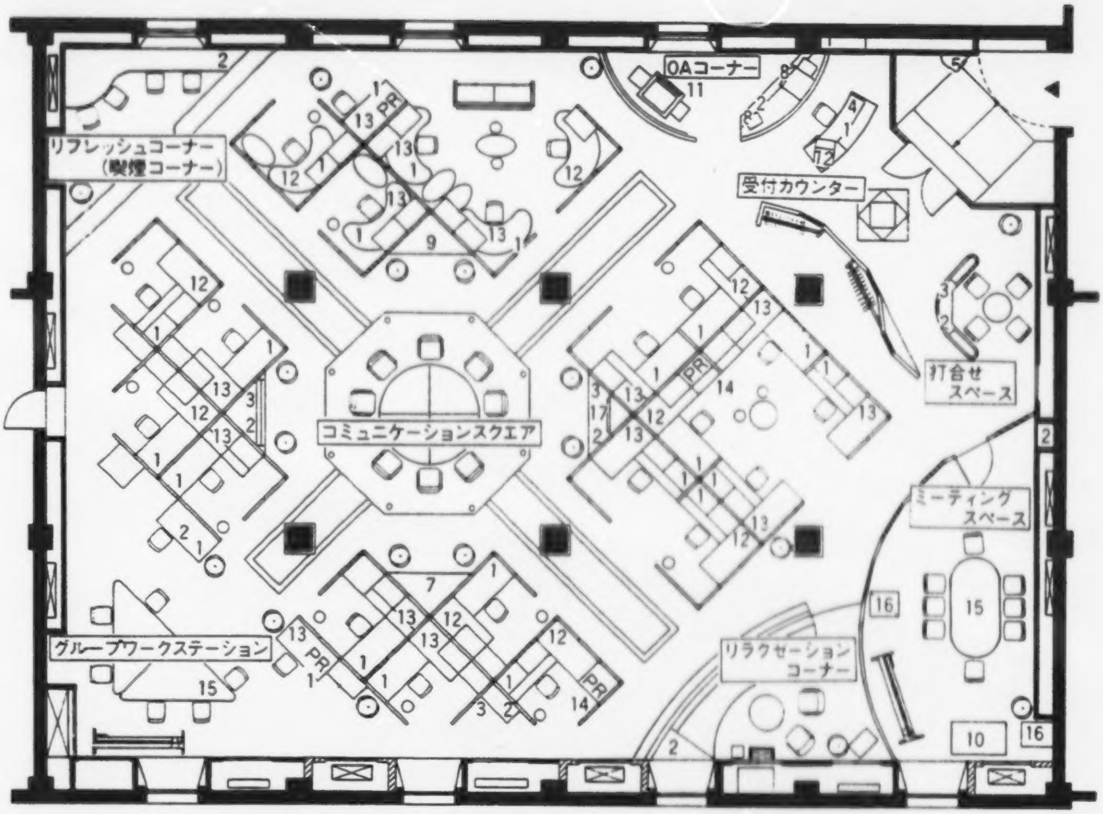

OAコーナー
リフレッシュコーナー
(喫煙コーナー)
受付カウンター
打合せスペース
コミュニケーションスクエア
ミーティングスペース
リラクセーションコーナー
グループワークステーション

Figure 12: Plan of Ageo Telework Center

Site Specific Usage

NTT considered the Ageo telework center to have 15 or 16 assignable workstations rather than the actual number of 25. This is because they wanted to keep some of them always open for group work. The number of registered users was about 50% of these 15 or 16 workstations, and 30% of these users used the office on a regular basis. The average number of users per day during February 1993 was 2.5 users per day. On the day of the site visit to the Ageo office, there were 5 users and the office administrator commented that so many users was unusual, but that they were there for a specific group project.

The corner seating area was frequently used for non-work related activities such as parties because it was isolated from the rest of the office.

Fuji Xerox's Musashino Community Office

Operating Company: **Fuji Xerox**
Site Location: **Musashino, Japan**
Number of Workstations/Offices: 17 workstations including 3 for temporary users
Number of Users: 10
Date Implemented: October 1988

Background

Fuji Xerox is affiliated with Xerox Corporation in the United States and Rank Xerox in England. Fuji Xerox has ¥621.2 Billion Yen in sales (5.2 Billion in US dollars at 120¥/$1) and 24,100 employees.

Fuji Xerox was very interested in providing better environments for their employees as part of the concept that they call the "New Work Way." New Work Way involves changes in the work environment, work characteristics, and attitudes towards work. The goal of these changes was to create a comfortable work environment that fosters the development of unique ideas, and the acceptance and purchase of new office environments, support equipment, services, and systems (*Fuji Xerox...*, 1993) The company was also adopting flextime and all of the users of the community office worked this way.

To help Fuji Xerox develop these concepts and promote "New Work Way," they were one of the seven participating companies in the Shiki Telework Center pilot project, which ran from October 1988-October 1989. They joined the Shiki project to help them learn about the impact of using telework centers.

The Musashino Community Office opened in October of 1989 for a one year trial period. It was located in a residential suburb of Tokyo about one hour from central Tokyo. There were originally two companies, in addition to Fuji Xerox, participating in the trial. At the end of the pilot both companies left. Since this time, Fuji Xerox has occupied the office alone, but with decreased space. The four goals of the pilot were (Fuji Xerox..., 1993):

- Explore the possibility of decentralizing people and jobs
- What is the relationship between the telework center and the community
- What is the impact of the telework center on the environment
- What is the definition, purpose, and profit potential of telework centers

In the pilot, Fuji Xerox used 12 workstations, Mitsui Real Estate eight workstations, and Nihon Sekkei eight. These were segregated into areas which were divided by waist high rolling metal gates. We could not ascertain whether the gates were kept open or closed, but their presence may explain why one of the hopes of the office was not realized; namely, the exchange and sharing of knowledge and information among companies. The office was originally 5,122 square feet (476 square meters), but the space was decreased at some point after the pilot.

Goals

- Create more leisure time for users
- Improve competitive advantages in intellectual productivity
- Decrease total costs in the office

Office Descriptions

Physical Environment

The 3680 square foot (341 square meter) office had room for 17 regular users plus drop in space for three additional users. This concept, called the "Spot Office", was being promoted throughout Fuji Xerox where space in their various office buildings was being dedicated for use as drop-in space by users with no connection to that building but who happen to need a place to work in the area. These spaces were reserved via a reservation system available over the networks.

The office also had a 12 person conference room, a six person informal meeting area, a bar height seating area for four, and two informal seating area. The quality of the finishes was very high and all of the meeting and informal areas were filled with expensive Japanese contemporary designer furniture. The workspaces, while generally open on several sides, were oriented so that the users had visual privacy. The drop-in area was the exception, where space for three users was located in an open triangular shaped area.

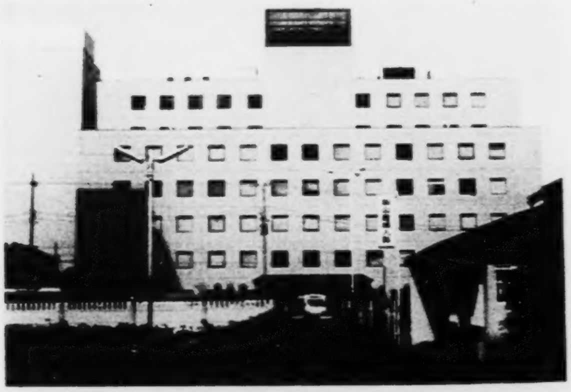


Photo 23: Exterior of Musashino telework center

Photo 24: Drop in area in Musashino telework center

Photo 25: Informal meeting area in Musashino telework center

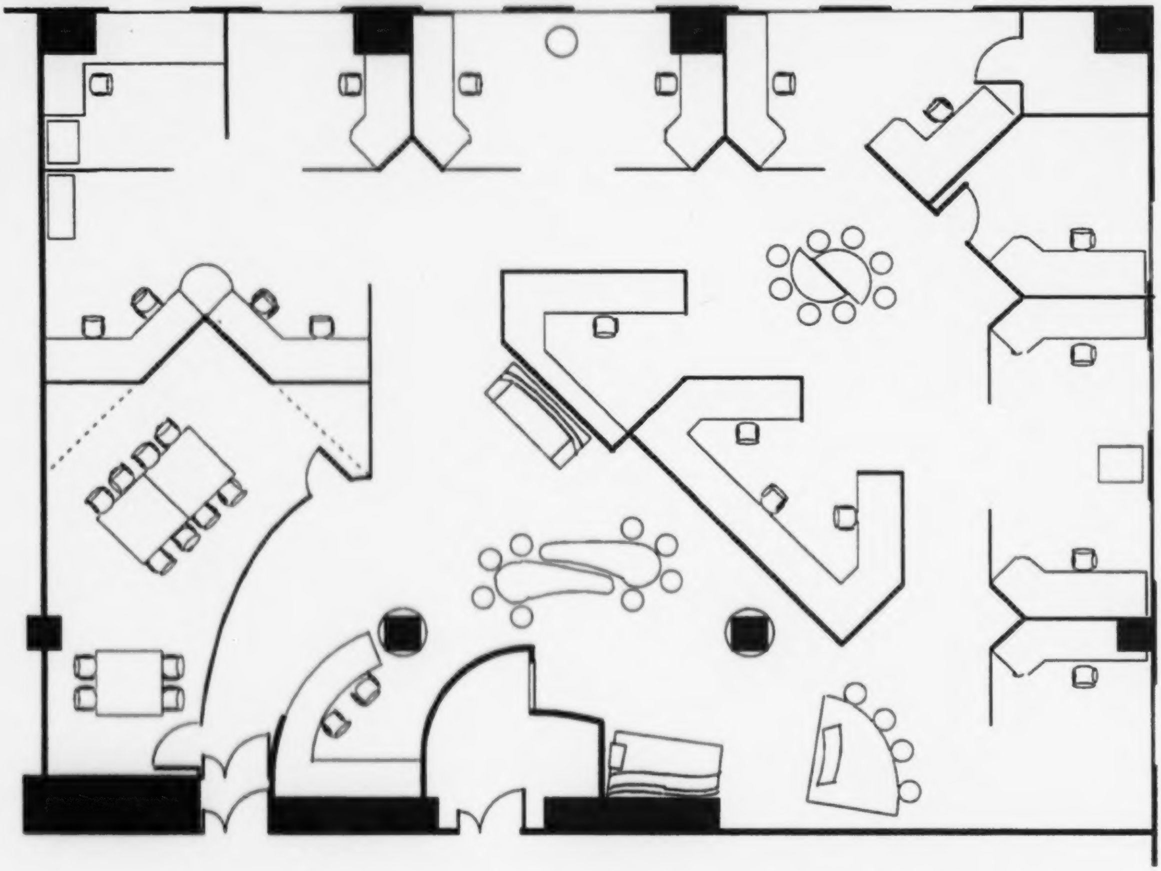


Figure 13: Plan of Musashino Community Office

Technology

The office was equipped with high quality networked PC's and EWS (Engineering Workstations) which were connected to the rest of the company and specifically the other half of the department. One unusual aspect of the office was the abundance of photocopiers.

The conference room had a tool for collaboration called "Smart 2000" which combined a computer equipped with a table and an electronic whiteboard that enabled users to work with colleagues in one or more different locations. Writing on the tablet appeared on the white boards in multiple locations.

Administration

There was one full-time administrator working in the office from 9:00 am to 5:30 pm ,who functions include reception, tea service for visitors, conference room reservations, and typing.

Use Patterns/Evaluation

Usage

Eight people were assigned to use the office full-time: Six in one group and two others from different departments. The two other users were in separate, unrelated departments. All of the users had assigned desks at the community office and the non Document Engineering Department members also had assigned desks in the central office. It was not known whether they only used the office part-time.

Types of Users

In the pilot which ended in October 1990, users all volunteered to work at the telework center and had to live less than a half hour commute away. However, in the current practical stage, commutes can be longer and users were chosen by supervisors. There was not necessarily any connection between the assigned users of the office and the temporary drop-in users.

Six of the eight users of the office were working on the same project (this was not always the case) in the Document Engineering Department, which had a total of 80-90 persons. The other members of the department were split between two other locations.

Performance

The three users interviewed felt that their performance had improved. The reasons given were that it was a quieter office with more work space that allowed them to concentrate and relax. Two of the users also felt that the overall quality of the work that they produced was higher because of these factors.

Communication

All of the users interviewed relied heavily on e-mail for their communication, even within their project group, all of whom were in the same office. One user said that it was more difficult finding their supervisor because of the high panels which prevented one from seeing at a glance who was in the office (as opposed to a traditional Japanese office without panels).

All of the users interviewed felt out of touch with and some degree of alienation from the company. One of the users said that with this also came a sense of freedom and flexibility in work style.

Travel Calculations

One person saved 40 minutes each way and the other saved 30 minutes each way. The third user however, required an extra 15 minutes each way.

Future

The Fuji Xerox Community Office is now considered a regular full-time office. The benefits for the user and the costs involved in providing an office with such a large amount of space per user will probably determine the office's long term use.

It is also worth noting that in many ways the office has become more like a branch office, with six of the eight users are working in the same department on the same project.

Appendix B:
Supplemental Case Studies of Telework Centers

New York Telephone's Mineola Telecommuting Center

Operating Company:	**New York Telephone**
Site Location:	**Mineola, New York, USA**
Number of Workstations/Offices:	25
Number of Users:	100
Date Implemented:	March 1993

The New York Telephone Mineola Telecommuting Center is located on Long Island about 25 miles away from NY Tel's Manhattan office. The center has 25 workstations and a conference room in a 2,500 square foot area. The center is located in one of the company's central office facilities. This facility had vacant space as a result of the decreasing size of NY Tel's telecommunications equipment.

The center was an attempt by the NY Tel Real Estate department to utilize some of their two million square feet surplus office space. Four or five business groups were approached by Real Estate to use the Telecommuting Center.

Currently 100 users work at the telecommuting center on assigned days. If users wish to work at the center on more than just their assigned days, they can call the NYC office and reserve one of a number of unassigned workstations set aside for such purposes.

All of the current users are managers. The company had originally intended for non-managerial level employees to use the telecommuting center as well, but union difficulties prevented these employees from participating.

There is no full-time administrator for the office. Instead, one of the users is assigned to perform certain basic operations on a rotating schedule such as reporting equipment problems or ordering additional supplies. This arrangement requires very little time and has worked smoothly.

When the center first opened in March of 1993, the equipment did not adequately meet the needs of the users. The equipment was old PC's left over that did not have capabilities to run all of the programs that the users needed and were not connected to the central computer systems in any way. The center will be closed from December 15 through December 31, 1993 to upgrade all of the computer equipment to state of the art. By 1994, the center will have 486 computers with dial up access to the corporate network. The center also has a NYNEX Shuttle, a video teleconferencing system for broad band lines that is currently for NYNEX internal use only.

Employee use patterns vary at the center. Approximately half of the assigned users work at the center on a regular basis. The remainder of the assigned users work only periodically at the center. NY Tel is hoping that utilization of the telework center will increase and become more regular when the new equipment is installed.

GSA's Shenondoah Valley and Hagerstown CASU Telecommuting Centers

Operating Company:	**Government Services Association (GSA)**
Site Locations:	**Winchester, VA**
Number of Workstations/Offices:	14 workstations
Number of Users:	60 users
Date Implemented:	September 1993
Site Locations:	**Hagerstown, MD**
Number of Workstations/Offices:	5 workstations
Number of Users:	2 users
Date Implemented:	September 1993

GSA Centers:

As part of their Flexiwork program, the US Federal Government decided to open 10-12 telework centers throughout the United States. These telework centers were scheduled to open by mid-March 1994. The government provided money to subsidize these offices for three years. Initially, these offices were available only to federal agency employees. Eventually, they will be marketed to employees of state and local governments and private firms as well.

Potential users for each center were identified using their zip codes. Each of the centers then did—and must continue to do—their own marketing to attract users.

Departments who arrange to rent workstations are charged a subsidized 100 dollars per month per workstation. This fee represents about 20-25% of recurring charges.

Shenondoah Valley Telecommuting Center

The Shenandoah Valley Telecommuting Center is a 2,000 square foot office located on a closed pedestrian walkway in downtown Winchester, VA. It currently has 14 workstations but there is room to expand if the need arises. It is utilizing new furniture lines designed by Steelcase (e.g., Harbors and Commons) and Hayworth to support collaborative work .

Currently there are only a few users who have received approval to use the telework center and have begun using the center. Sixty additional individuals are currently seeking approval to begin using the center. These upcoming users are a mix of union and non-union employees (which is unusual compared to other centers' difficulties securing union approval).

The FDA is considering using the center for short term interdisciplinary team projects involving at least six people. Unlike many users of telework centers, these teams would not use the office because of convenience or commuting reasons, but because the center's dedicated team environment would be more effective for the different team projects. Relocating short-term project teams to the telework center would also provide a way for the FDA to avoid disruptive space rearrangement in the central office.

In addition to the team spaces and individual workstations, the center also has a small meeting room, kitchen, photocopier, fax, and printer. Each workstation is equipped with a telephone and a 486 computer with software and modem.

Hagerstown CASU Telecommuting Center

The Hagerstown Cooperative Administrative Support Unit (CASU) Telecommuting Center is located at Hagerstown Jr. College in Maryland. The center currently has five workstations and two users. The center is located at the college temporarily until mid January 1994, when it will be moved to a permanent facility in downtown Hagerstown. The new facility will have room for up to 35 workstations.

Equipment at the new center will be similar to that at the Shenandoah Valley center. Used furniture is being donated to the project.

Marketing for potential users to fill the center is currently in progress.

Global Telematics' Ballard Telework Center

Operating Company:	**Global Telematics**
Site Location:	**Ballard, Washington**
Number of Workstations/Offices:	n/a
Number of Users:	0 users
Date Implemented:	Fall 1990

The Ballard Neighborhood Telework Center is an interesting example of a telework center that did not work. The center was intended to be a money-making endeavor; the center did not have government funding and profits went to the owner. Just as it was opening, however, the Washington State Energy Office opened their highly publicized telework center three miles down the road. The WSEO center closed one year later due to lack of government funding, but not before the Ballard Telework Center had virtually failed.

The 1,600 square foot office occupies surplus space in an existing company's 4,000 square foot building. The Ballard center is a fully configured space (Herman Miller donated furniture), but no users were ever signed on to use the space. The center tried recruiting companies for between $500 and $800 per month per workstation, although with today's market values $850 per month per workstation would be the break-even point.

The space is currently used as overflow space for the company that own the building and is also lent to non-profit groups who need short-term office space.

Simi Valley TMA Neighborhood Telecommuting Center

Operating Company:	**Simi Valley Transportation Management Association**
Site Location:	**Simi Valley, California**
Number of Workstations/Offices:	4 workstations
Number of Users:	0 users
Date Implemented:	October 1992

The Simi Valley Neighborhood Telecommuting Center, like the Ballard Telework Center, is a userless center. Simi Valley is an area with a population of about 105,000 people, many of whom commute 35 miles to downtown Los Angeles on a daily basis. Marketing was done by contacting employers and putting announcements in various traffic-oriented publications. Surprisingly, even though residents have such a tough commute, no one has yet to express any interest in using the center.

The center opened in an existing governmental building and consists of four workstations with telephones. The cost of renting a workstation is $300 per month including phone line, copier, and fax. Users pay their own long distance charges.

Pac Bell and MTA's Concord and San Jose Telework Centers

Operating Company:	**Pacific Bell and MTA**
Site Locations:	**Concord, CA San Jose, CA**
Number of Workstations/Offices:	14 workstations and 3 offices
Number of Users:	2 users
Date Implemented:	September 1993
Site Locations:	**San Jose, CA**
Number of Workstations/Offices:	20 workstations
Number of Users:	0 users
Date Implemented:	September 1993

These two telework centers have just recently opened with funding primarily from the MTA and Pacific Bell. The goals of this project are twofold. First, the government is interested in finding out if telecommuting centers are viable options for alternative ways of working. Second, Pacific Bell is interested in increasing telephone usage among the users. The telework centers are available to any company wishing to rent workstations or offices in the space.

The rates are $400 per month for a workstation and $600 per month for a private office. These costs represent the break-even point based on rent plus equipment rental rates assuming a 65-70% occupancy rate. In addition, users pay for photocopies, fax and long distance telephone calls. The centers are staffed by a resource person (Monday-Friday, 9-5) who performs secretarial services for the centers' users.

The funding for the project lasts until the end of August 1994.

Concord Telecommuting Center

The Concord Telecommuting Center is located in a small business park with about 20 offices and 2 restaurants. It is a 2,750 square foot office that currently has one company signed up. The company will probably assign two users to the center, two days per week each.

San Jose Telecommuting Center

The San Jose Telecommuting Center, located in a office park in a light industry area, has 15 workstations and 2 private offices in a 2,940 square foot facility . Currently there are no users, but Pacific Bell will probably lease space in the facility in the near future.

Pac Bell's North Hollywood and San Francisco Satellite Offices

Operating Company:	**Pacific Bell**
Site Locations:	**North Hollywood, CA**
Number of Workstations/Offices:	5 workstations
Number of Users:	4 regular users
Date Implemented:	May 1985
Site Locations:	**San Francisco, CA**
Number of Workstations/Offices:	4 offices with 10 desks
Number of Users:	n/a
Date Implemented:	May 1985

In May of 1985, Pacific Bell decided to pilot a telecommuting program for 100 employees. As part of this pilot two telework centers with 5-6 workstations were opened in San Francisco and Woodland Hills. Both of these were in leased properties which came due in 1988. When the leases expired both offices were moved to corporate facilities nearby (the Woodland Hills center moved to North Hollywood) that had surplus space.

All of the users are non-union members because of the fact that the primary Pacific Bell employee union had made specific statements against its members telecommuting. This policy is changing, however, and Pacific Bell currently has begun a trial with some union people.

Neither of the two offices have any form of administrative support. Users have assumed the responsibility of ordering supplies. In the event of any problems (such as equipment breakage), users can call an outside office to make the repairs.

Some of the users work on a fixed schedule and others use the centers flexibly, depending on the users' agreements with their supervisors.

The equipment in the offices consists of IBM AT's and XT's which have been networked.

North Hollywood Telework Center

This center is in a small area in a building, with 5 cubicles surrounded by 6 foot high partitions. There are four users who have assumed "squatters rights" on four of the workstations and work there regularly. Additional users work in the center, but not on as regular a basis. All of the users have central office locations in Los Angeles.

San Francisco Telework Center

This telework center supports a large residential population in the downtown San Francisco area. All of the center's users have a central office location in San Ramone, thirty miles from San Francisco.

The telework center is situated in a 1940's building with a double loaded corridor and private offices. Four of the private offices are connected by glass paneled doors with 2-3 desks per office.

Similar to the North Hollywood Telework Center, the San Francisco center has both regular and occasional users.

Appendix C:
Detailed Case Studies of Resort Offices

Izumigo's Yatsugatake Resort Cottages

Operating Company:	**Izumigo**
Site Location:	**Yatsugatake, Japan**
Number of Workstations/Offices:	5 cottages plus lodge with private rooms
Date Implemented:	April 1991

Background

Yatsugatake Highland is a mountain resort area located three hours (by train or car) from Tokyo, Japan. Izumigo is the largest real estate developer in the region, a region which is primarily filled with resort properties. Izumigo rents out both resort offices and cottages at Yatsugatake on three million square meters of property.

One of the founding principles of the resort office concept is the theory that leisure activities positively influence work productivity. To test this concept, the Office Decentralization Promotion Committee in Japan's MITI (Ministry of International Trade and Industry) established a project called the Yatsugatake Resort Office Research Group. This project is run by the Resort Office Department. This project was the first MITI-initiated research on resort offices. Founding members of the Yatsugatake Resort Office Research Group included: Assics, Izumigo, Uchida Yoko, Uchu-tsushin, Shimizu Construction, Hitachi, Fukoku Life Insurance and Mitsubishi Trust Bank.

Yatsugatake is not Izumigo's first foray into the resort office/cottage concept. Before opening the facilities at Yatsugatake, Izumigo piloted 2 lodges in Azumino. These lodges have since closed down.

The funding for the resort cottage pilot came primarily from Izumigo and the founding members of the resort office. The cost of a one year membership was one million yen. The benefits of membership include half price usage of the cottages, 50 days of usage guaranteed, and a discount on other services offered. After the one year pilot ended, there were only 3 members remaining. These included Hitachi, Objet (a consulting firm), and Berth (a real estate company).

Goals of the Yatsugatake Resort Cottage Demonstration Project

The goals of the Yatsugatake resort cottage pilot project were:

- To determine whether displaying a complete resort office/cottage affects the popularity of such offices.
- To test the effects of the resort office concept on individual productivity and creativity.
- To test and evaluate the hardware and software which enables the practical use of resort offices.
- To evaluate marketing techniques for resort offices by looking at the economic effects on the surrounding community.

- To study the possibility of developing additional resort office facilities.
- To expose potential problems of working in resort offices/cottages.
- To develop ways to popularize resort offices as a social system.

The pilot of the resort cottages ended at the end of March 1992. At that point, Izumigo decided to continue operating the resort cottages.

Resort Cottage Descriptions

Physical Environment

Table 7: Statistics of Yatsugatake Resort Cottages

	A	B	C1e & C1w	C2	Core
Size	1,123 sq ft	1,332 sq ft	1,684 sq ft each	1,454 sq ft	2,937 sq ft
Number of bedrooms	2	2	4 each	4	0
Max. # of users	4	4	7 each	7	0
# of workstations	2	2	4	4	4
Notes		VIP version of A with higher level of finishes including Jacuzzi	e & w= east and west	version of C1 with group meetings space	Has 20 person conference room, sauna, fitness center, and cafe

All of the cottages were contemporary buildings that looked similar to ski chalets. The 5 cottages were located behind a central lodge which was shared by all users of the cottages. In general, all of the cottages shared the same decor, with some differences in amenities (e.g., Cottage B had a Jacuzzi). One of the cottages, however (C2), included some team meeting space.

Photo 26: Exterior of a Yatsugatake cottage

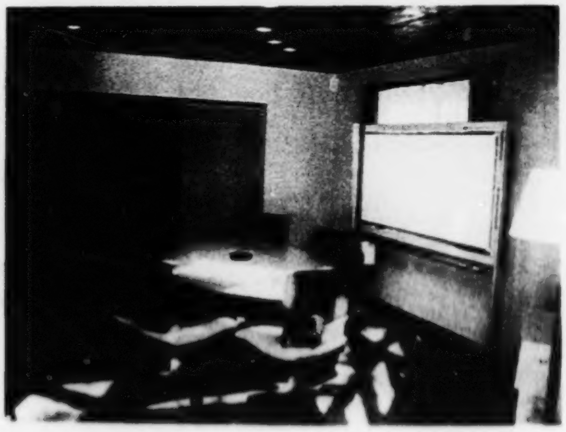


Photo 27: Meeting area in a Yatsugatake cottage

The downstairs level of each cottage was dedicated to relaxation space. Each was decorated with natural wood, and consisted of a tatami room, spiral staircase, comfortable seating, a television and a small kitchen area. The tatami rooms was also intended to act as sleeping spaces for either two or three additional persons. These rooms were equipped with futons and linens in special closets with futon dryers built in.

The second floors were filled with the individual work areas and private bedrooms.

Cottages "A" and "B" were intended for two users, with Cottage B considered the VIP version. This cottage featured an even higher level of finishes, such as a Jacuzzi instead of a tub, a fireplace, and more space. The VIP cottage was also the least utilized of all of the cottages, possibly due to its higher rental charge.

All three of the "C" cottages had four private bedrooms plus could sleep an additional three people in the tatami room.

The core lodge provided the visitors with a 20 person conference room, fitness center, sauna, and cafe.

Photo 28: Individual work area in a Yatsugatake cottage

Photo 29: Brainstorming session by Yatsugatake users

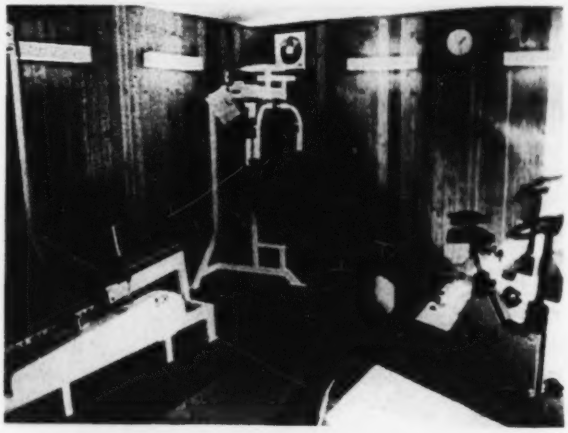


Photo 30: Fitness center at the Yatsugatake lodge

Technology

The core lodge's conference room was equipped with a copier, projection TV (70") for teleconferencing and presentations, video projection device, stereo, s-vhs, laserdisk player, fax, computer, paper shredder, and a book binder. There was also a book case with the latest best seller fiction books, plus non-fiction and business related magazines.

Each cottage had at least four telephone lines; two to four cordless business voice phones, a fax line, and a non-business voice line. Computers (Macintosh or PC's), printers and modems were available for free if reservations were made, but they were not automatically supplied. Each cottage had its own copier, fax, printing white board, television and VCR with satellite hookups. The cottage with team meeting space had an extra long printing white board near the conference table.

Administration

The number of support staff for the resort cottages varied by season and time of day. During the winter there would normally be two full-time staff people, three during the summer, and always one on the night shift. These administrators/ concierges provided the front and back house services like any resort, plus special functions associated with resort cottages, such as providing technical support for the conference room, providing computer equipment, and arranging car rental and food service. They also supported office work by performing secretarial functions, mail and message services, and maintaining the office equipment.

Costs

The costs for using the Yatsugatake Resort Cottages are as follows in Table 8.

Table 8: Usage fees at the Yatsugatake Resort Office

Office Type	Capacity	Basic charge per day	Charge per additional person
A	2-4	15,000 ¥	7,000 ¥
B	2-4	20,000 ¥	10,000 ¥
C1/C2	4-7	30,000 ¥	7,000 ¥

Evaluation/Usage

Usage and Performance

Users could check into the resort office at 3:00pm and must check out by 10:00am. These check in-out times seem contrary to the whole concept of resort offices—combining work and leisure—because in order for a person staying only one night to work more than about two hours each day, he/she will have to work during their "off" leisure time.

The average length of stay in the cottages from May 1992 to March 1993 was about one and a half days (see Table 9).

Table 9: Average Usage 5/1/92 to 2/28/93

People per lodge	3.79
People per reservation	5.5
Length of stay	1.47

The most popular cottage was the cottage intended for team collaboration (see Table 9). If one considers why many companies use the resort cottages—to go to a private area with few distractions to conduct brainstorming, planning, or group meetings—the popularity of this particular cottage is not surprising.

During both years Cottage B, the VIP user cottage, had lower usage than the other cottages, possibly due to its higher cost.

Table 10: Utilization by Cottage

	A	B	C1e	C1w	C2	Total
YTD 1993	23.70%	15.00%	24.30%	16.80%	30.20%	22%
YTD 1992	47.30%	37.20%	40.70%	36.30%	51.90%	42.7%

Interesting to note was the drop in utilization from 1992 to 1993 for all of the cottages; in 1992, cottages were in use 42.7% of the time, while in 1993, the use rate decreased to 22%. Tracking the types of users for 1992 (see Table 11) indicates that use by members of the resort office far outnumbered that of other types of users (ordinary users, Izumigo Best Club users, guided visitors, and potential members). In 1993, use of the resort cottages by members decreased, while use by all other types of people increased.

As mentioned earlier in the report, the number of member organizations decreased in 1993, thus explaining the drop in utilization. These figures emphasize, however, the importance of recruiting these member organizations in order to sustain the resort cottages.

Table 11: Users of the Offices

	Ordinary Users	Members	Izumigo Best Club	Izumigo	Guided visitors	Potential Pilot Members
YTD 1993	22.60%	12.8%	10.10%	21.00%	0.30%	33.20%
YTD 1992	20.10%	63.20%	0.00%	17.20%	0.00%	0.00%

Users who visited the cottages for work purposes did not at any time bring family members with them. Some users, however, reserved the cottages for vacation, at which times they were accompanied by family members. Although Izumigo rents other cottages at Yatsugatake specifically for recreation, the high quality of the resort offices entices users to come back for vacation.

Thursday and Friday were historically the most popular days for users to stay at the resort cottages (see Table 12). Many people in the past have chosen to stay the weekend, either renting the resort cottage (as appears to be the growing trend in 1993), or renting one of Izumigo's less expensive vacation cottages for the remainder of their stay.

Table 12: Usage by Days of the Week

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
1993 YTD	10.10%	11.20%	13.40%	19.60%	18.30%	18.50%	9.00%
1992 YTD	14.60%	13.30%	14.10%	17.90%	19.60%	11.90%	8.60%

The Yatsugatake Resort Office Research Group conducted a survey of almost 800 resort cottage users at the end of the one year pilot. The information in Tables 13-18 was obtained from the results of this survey (Yatsugatake Resort Office Research Group, 1992).

The majority of resort cottage users were male. The 38-44 age bracket constituted the largest age group for male users. Forty-eight percent of all females that used the resort cottage were under the age of 25. One explanation for this trend is the fact that women in Japan typically work during their early years and in their late years, taking a career break in the middle years to tend to the family (Rosario, 1992).

Table 13: Yatsugatake Resort Office Users by Gender and Age

Males/Females	83.7%/16.3% (664/129 users)
Males 38-44 years old	27.6%
% of Females under age 25	48%

The resort cottages were used more frequently by R&D people versus planning or sales (see Table 14). It is unclear whether the sales employees used the resort cottage for team meetings, to entertain clients, or a combination of both.

Table 14: Yatsugatake Resort Office Users by Job Types

R&D	31.4%
Planning	22.4%
Sales	14.2%
Other	32%

The survey indicated that people were able to work more creatively in the resort environment than they had anticipated. However, user satisfaction in terms of stress relief and work efficiency in the resort cottages was lower than they had expected. Again, looking at the average number of days that users stayed at the resort cottages, it is possible that users were not able to relax as much as they had anticipated because of the short length of stay and the check in-out hours.

Table 15: Yatsugatake Resort Office Expectations and Satisfaction

	Expectations before using	Satisfaction after using
Creative work	39.3%	40.5%
Relieve stress	37.5%	29.9%
Efficient work	31.8%	28%

Looking a the working times for the resort office users, users preferred to work on a free schedule in which they could choose their own working times, while, given a choice, bosses preferred that their employees maintain a schedule similar to the office.

Table 16: Yatsugatake Resort Office Working Times

	Expectations from the boss	Actual usage
Nothing	21.6%	
Same as office	21.8%	24.8%
Free schedule	18.9%	28.8%
Flexible schedule	12.9%	12.9%

The majority of users stated that ideally they would prefer to stay at the resort cottage every 2-3 months for 4-6 nights to generate planning ideas and conduct meetings in teams with 3-4 people (see Table 17)

Table 17: Yatsugatake Resort Office Desirable Usage

Desirable Work	Planning ideas	65.2%
	Meetings	61.4%
	Planning documents	43.8%
	Writing documents	36.6%
Desirable Workstyle	Individual work	32.2%
	Teamwork with 3-4 people	61.2%
	Teamwork with 5-10 people	35.4%
Desirable Length of stay	1 night	9.2%
	2-3 nights	35.8%
	4-6 nights	40.5%
	more than 7 nights	0.4%
Desirable Frequency of stay	monthly	11.3%
	every 2-3 months	35.3%
	every 6 months	34.2%

Although the majority of users were satisfied with their ability to perform work and leisure activities, users indicated that they were less satisfied with their ability to partake of leisure activities than they were with their ability to perform work (see Table 16).

Table 18: Yatsugatake Resort Office Satisfaction with Work and Leisure

Work	76.5%
Leisure	62.0%

Communication

The communication equipment provided at the resort cottages allows users to communicate in a variety of ways (i.e., by telephone, fax, e-mail, etc.). The cost to the user, however, made intensive telephone usage un-economical. For calls originating and terminating in Tokyo, the charge is 10¥ for 3 minutes, but calls from Yatsugatake to Tokyo cost 100¥ for 1 minute (an increase of 3,000%).

Shonan Resort Office

Operating Company:	**Shonan Resort Office**
Site Location:	**Shonan, Japan**
Number of Workstations/Offices:	16 work areas at 4 large tables
Date Implemented:	June 1992

Background

The Shonan Resort Office Study Group was established in September of 1990 to help encourage economic activity in the Kanagawa Prefecture. Monthly meetings were held to study the work style characteristics of the Shonan area and their applicability to resort office. Members of Azumino (a resort office project) and Shiki (founders of one of the first satellite offices in Japan) assisted in planning the Shonan resort office.

The Shonan Resort Office company was capitalized with 20 million yen, 70-80% from individual members and the rest from companies (such as Itoki, a Japanese office furniture company). At the time of the opening in 1990, there were 26 members. Since that time the number of members has increased.

The office is located in a building above a very small strip mall (four businesses) in Hayama. The office is 15 minutes by bus from the nearest railway station which is an hour away from Tokyo. The area, which used to be a seaside resort has changed over the years and is now (partially) a residential neighborhood for people who work in Tokyo. The local government and the residents hope to bring new jobs into the area.

Goal

Again, the primary goal of the Shonan resort office is to make new jobs in the Hayama Area

Office Description

Physical Environment

The Shonan Resort Office is located on the top floor of a small commercial development. The office area is 831 square feet and contains a large central work area, a conference room with attached kitchen, a reception area, and a sleeping loft accessible via ladder. The facility also includes bathrooms and a shower with the idea that people could stay overnight at the resort office in the loft.

The main room contains four large worktables (47" x 106"), each containing space for four people to work comfortably. Other than in the conference room, there is no privacy and sound carries very easily through the office. The 155 sq. ft. conference room has seating for another six people.

Technology

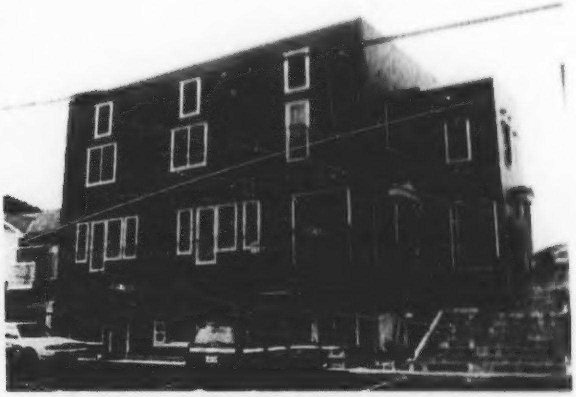
The office has three telephone lines plus one fax machine, a copier, and a printing white board. There are also three computers provided for staff only. A 50" projection TV with a stereo and VCR is located in the conference room.

Administration

There is the equivalent of one and a half full-time administrative jobs shared by four part-time people from the community. There is usually one staff person in the morning and two in the afternoon, but this is determined by the work load.

This office differs from all of the resort offices studied so far in that it offers full secretarial services as part of the package. Staff members perform the following services; telephone, mail, faxing, copying, shopping for supplies, restaurant recommendations and reservations, word processing, and data entry.

The office is staffed from 9am to 5pm, but users have 24 hour access.



. Photo 31: Exterior of Shonan Resort Office

Photo 32: Interior of Shonan Resort Office

Photo 33: Shonan Resort Office work area

Costs

Members are charged a joining fee, a yearly fee, and a monthly fee, in addition to a per usage fee. Table 19 lists the different costs associated with each kind of membership.

Table 19: Costs of Using the Shonan Resort Office

	To Join	Per Year	Per Month	Per Use
Individual	20,000 ¥	10,000 ¥	10,000 ¥	500 ¥
Company	20,000 ¥	30,000 ¥	30,000 ¥	500 ¥
Executive	20,000 ¥	150,000 ¥	150,000 ¥	Free
Address	20,000 ¥	50,000 ¥	50,000 ¥	3,500 ¥

Other charges associated with the office include: 1) if members bring guests to the office, 5,000 ¥ per day, and 2) if members use of the loft, 2,500 ¥ per night per person. Use of the copier, fax, and PC's is free. Information on telephone charges was not available.

Use Patterns/Evaluation

Usage

No specific usage statistics were available. When the office opened, there were 26 members. That number has increased to approximately 50 members. There are four classes of membership available. These are individual, company, executive, and address. Individual and company members can use the services whenever they want. Companies can have up to three users per membership. Executive members can have individually assigned desks. Address users are users who do not work in the office but have access to the services. All of the current members are either individuals or companies.

No historical information was available regarding utilization rates. The sign up sheet for the month of April revealed very low utilization based on the number of reservations. Less than half of the available days had anyone scheduled to use the office.

One of the original intents of the resort office was to have people stay at the office for multiple days using their sleeping facilities and showers. But in actual usage this has not proved a worthwhile option. The sleeping loft is currently used for storage. Most of the members live near enough to not need these services or make other sleeping arrangements when they visit the office.

Types of Users

Three types of users were identified at the beginning of the project. These include:

- Self employed people living and working in Hayama who could use the office full-time if they made reservations.

- People telecommuting to Tokyo part-time (1-2 days per week).

- People who live and work in Tokyo and who use as a resort office on weekends or one to two days per week.

The user profile at the time of this study was different from these three definitions. There were no users who used the office as a full-time work location. There were some members who lived and worked in Tokyo, but they had not actually used the office. There were two companies (a restaurant and a car dealer) in Hayama who used the conference room for monthly meetings (these companies paid a 5,000 ¥ per person charge per meeting for more than three attendees).

Another member of the office was hired by a foundation funded by the Kanagawa prefecture and was using the office to have the staff enter and analyze a questionnaire. One of the staff members was assigned to key-punch the responses to the questionnaire.

User job descriptions include: a restaurant chain manager, a law consultant, an audio/visual producer, an engineer, and a building equipment designer.

Performance

An interview with the resort office administrator revealed that the intent of the office is not to improve work efficiency or performance, but to provide work facilities in a resort area. He feels that location in a resort area is among the most important aspects and is considering a program for sea side strolling. He also relayed that user satisfaction has been high for meetings and training when the resort environment can be enjoyed.

Future

From the opening, the Shonan Resort Office was never considered a pilot project, but rather a business. As a business, the office does not seem to be where it should be in terms of membership. There were only half the number of members needed to break even financially after nine months. It seems improbable that the office will be sustainable without increasing its membership. If, however, the effect of the office on the economic activity of the community is favorable, it is possible that this benefit will outweigh the negatives.

Appendix D:
Key Questions of the Telework Center Survey

User Interview Questions

Background Information

- Demographics: age, sex, marital and family status, job type, department, company, etc.
- How long have you used the telework center?
- Have you had previous experience with telecommuting?
- How were you chosen to use the telework center? Did you volunteer? If so, why?
- Were you involved in planning the telework center or the facilities and equipment available? If yes, were you satisfied with the results? What would you do differently (planning, design)? Why?

Communication Patterns

Coworkers

- Who are the primary people with whom you interact while in the central office?
- For what purpose do you interact with them (team projects, seeking them as a resource, as suppliers/customers affecting your personal work, etc.)?
- Are these interactions mostly face-to-face, by telephone, and/or in large group meetings?
- How do you interact with people in the central office when you work in the telework center?
- How do you compensate for the lack of face-to-face conversations with others in your department or work group when you work in the telework center?
- Are there other telework center users in your department or work group? Are they using the same telework center?

Others outside the company

•How do you normally communicate with people outside the office, such as clients or suppliers (i.e., by fax, telephone, personal visits)?

•Does this communication pattern change when you are using the telework center? If so, how? Is it easier/harder to visit others and/or to call them?

- How does the location/remoteness of the telework center affect your relationship with these people?

Relations with manager

- Was your manager supportive of your using the telework center when you first began?
- How does your manager feel about it now? What does s/he think of as the benefits/problem issues?
- Have you set up alternate means of communication with your manager to remain abreast of developments in the office?
- Does your manager review your performance regularly? What is the basis for assessing your performance? Have the criteria changed (to your knowledge) as a result of your using the telework center?
- Do you feel you are evaluated on the same criteria/level of expectation as your peers?
- Do you feel that your manager understands how you work and what you do?
- Has the telework center had any positive or negative impacts on your relationship with your manager?

Telework Center

Feeling of attachment to company/social integration/isolation

- Does using the telework center make you feel less attached to the central office? What about to the company itself?
- Do you feel as much a part of the informal interaction in the office as you did before? If not, what do you feel you miss by not being there? How do you compensate for it?
- Do you feel as "in touch" with the central office goings on as before? How do you deal with this?

Productivity

- Would you characterize your overall effectiveness in the telework center as better than, worse than, or about the same as in the central office?
- Can you give a specific example (story or anecdote) to illustrate exactly what is affected in terms of work activity.
- Do you feel that you are as productive a member of the central office team as before? Has the nature of your contribution changed?
- How do you define your personal "productivity"?

Morale

- Do you enjoy using the telework center?
- Does using the telework center increase your morale while working?
- Has the telework center affected your stress level? How?

Technology support/equipment

- Are the technical supports offered to you in the telework center adequate to meet your needs?
- Which types of equipment do you use most often ?
- Are there types of equipment available which you never use?
- Are there certain types of equipment that are not available to you that you feel you need? Please explain.

Support staff in telework center

- Is there adequate administrative support in the telework center (reception, telephone answering, secretarial assistance, etc.)?
- How often do you take advantage of the administrative assistance offered?

Physical design

- How does the physical design of the office impact your ability to work there?
- Do you feel you have an appropriate amount of privacy and quiet while in the office?
- Are there appropriate special functional areas for your needs (library, conference room, break areas, etc.)?
- Do you find the telework center a pleasant place to work? Does it feel welcoming to you?
- Do you find that you interact with other users of the telework center when you are there? Are these formal or informal interactions? Where do you normally interact?

Type of work "plan" when in telework center

- What type of work do you normally do in the telework center?
- How does this differ from a typical day's work in the central office?
- What determines what work you do where (available equipment, resources, time, environment, or just what needs to be done at any given point)?
- Do you save certain types of work for days you will be in the telework center (reading, writing, tasks which require a lot of concentration)?

Commuting patterns

- How has the telework center changed your commuting patterns over the week?
- Do you commute at different times of the day than you would if you were going to the central office?
- Are you able to avoid long commutes by using the telework center?
- Is it easier to run errands before, during, or after work from the telework center?

Home life

- How, if at all, has using the telework center affected your home life?
- What are some of the changes associated with your home life (access to day care, schools, errands)? Are these changes advantages or disadvantages?
- Do you also work at home in addition to the telework center? If yes, what is the "added value" to your work as a result of being able to work at home?
- Does the size or design of your home make it easy or difficult to work there? What changes in design, furniture, or equipment would be helpful or supportive?

Use restrictions/work schedule patterns/flextime

- How much of your time is currently spent in the telework center?
- Do you also work in other locations (at home, at a client, at another office)? If yes, in which of these settings do you work? How much of your time is spent there? What kind of work do you do in each setting?
- Have the times at which you work changed as a result of using the telework center?
- Would you like to use the telework center more or less than you currently do? Why? Are there restrictions on how much or little you can currently use the telework center?
- Do you agree with the use policies for the telework center? Would you change anything?

Co-Worker Interview Questions

- Which of your coworkers use telework centers?
- How are you involved with them as coworkers (project team, they act as resources, they supply information or are "customers," perform similar job functions)?
- How has their involvement in the telework center changed how you work with them?
- Do you compensate for face-to-face meetings by some other means (telephone, fax, e-mail, etc.)?
- Do you find that you have to "save" things to talk to them about for when they are in the office, or are they just as accessible when in the telework center?
- Do you feel comfortable calling the telework center to talk to someone?
- Do you feel that your productivity is better, the same as, or worse than before your colleague began working in the telework center?

Manager Interview Questions

- How large is your staff?
- Which of your staff use the telework center? How long have they been using it?
- What problems, if any, do you perceive with the telework center?
- Have you been required to adapt or re-think your management style as a result of their using the telework center?
- How do you evaluate the work of people who are only located in the central office?
- Is this the same criteria you use for telework center users? If no, then how do they differ?
- Is there variation in how informed about current events the employees are, divided by telework center users or non-users?
- Do you feel that the telework center users are more, equally, or less productive as they were prior to using the telework center? Are they productive in different ways?
- Do your staff seem to benefit from using the telework center? If yes, how?
- Have you found ways to compensate for lack of face-to-face interactions (telephone, fax, e-mail, etc.), or has that not been necessary?
- Do you often telephone staff at the telework center to follow up on issues, or do you wait to contact them?
- Are your staff as easily reached in the telework center as in the central office?
- When the user comes back into in the office, how do you expect/want them to use time there? Are these expectations different than if they were in the central office all the time?
- Do you feel that certain types of people are better suited for working at a telework center? What characteristics are important?
- Have any of your staff tried telecommuting/using the telework center and stopped? If yes, why?
- Were you involved in planning your staff member's involvement in the telework center? If yes, were you satisfied with the results? If no, how would you change things?

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